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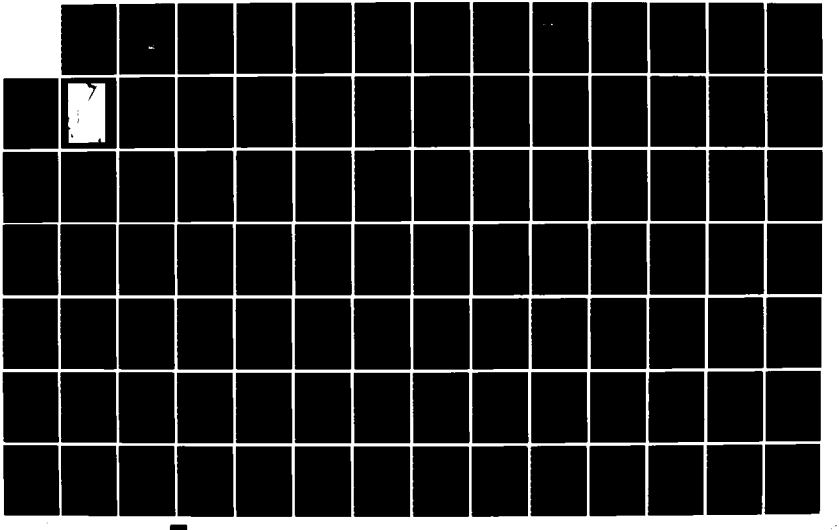

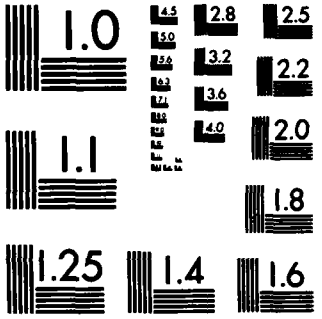

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CONNECTICUT COASTAL BASIN

HAMDEN, CONNECTICUT

AD-A144 583

FARM BROOK DAM (SITE I)
CT 00657

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DTIC FILE COPY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE (and Subtitle) Farm Brook Dam (Site 1) NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut Coastal Basin
Hamden, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The 1,210 foot long and 11 foot high dam consists of two earthfill embankments and a principal and emergency spillway. Based on visual inspection of the site and the past performance of the dam, the facility is judged to be in fair condition. The size classification (small) and the hazard classification (high) of the dam, the test flood will be between ½ the PMF and the PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

JUN 15 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Farm Brook Dam (Site 1) (CT-00657) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the owners and the cooperating agency for the State of Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

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A-1

FARM BROOK DAM (SITE 1)

CT 00657

CONNECTICUT RIVER BASIN

HAMDEN, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: CT 00657
Name of Dam: Farm Brook Dam (Site 1)
Town: Hamden
County and State: New Haven, Connecticut
Stream: Farm Brook
Date of Inspection: December 5, 1980

BRIEF ASSESSMENT

The 1,210-foot-long and 11-foot-high dam was designed by the U.S. Department of Agriculture Soil Conservation Services and constructed by the Nutmeg Construction Company in 1973 as part of a flood control program in the Farm Brook watershed. The impoundment is used to form a flood control pool but also serves as a recreational facility. The dam consists of two earthfill embankments and a principal and emergency spillway. Embankment No. 1 is 535 feet long, and embankment No. 2 is 580 feet long. A 35-foot wide grass-lined emergency spillway separates the two embankments. The principal spillway, located at the midsection of embankment No. 2, is a drop inlet structure consisting of a 2.5- by 7.5- foot shaft riser and a 80-foot-long, 30-inch-diameter concrete conduit, which empties into a concrete impact basin located on the downstream slope of the dam. The low-level outlet consists of a 15-inch-diameter drain incorporated into the upstream wall of the spillway riser. Flow through the outlet is regulated by a hand-operated sluice gate.

On the right abutment of embankment No. 2 is a diversion ditch that is about 3 feet wide at the bottom and has 2.5:1 side slopes and a bottom elevation, at the centerline of the dam, of 288.2 NGVD, which corresponds to the emergency spillway crest elevation. The Soil Conservation Service design drawings indicate that the lowest portion of the left bank of this ditch is at elevation 291.25; therefore, there would be no spillage behind

the dam before the dam itself was overtopped. In addition, despite the bottom elevation of this ditch, at the centerline of the dam, the ditch will not supplement the project discharge during the test flood since the bottom of the ditch has an uphill grade in the downstream direction.

Based on the visual inspection of the site and the past performance of the dam, the facility is judged to be in fair condition. No evidence of instability was noted in the dam or appurtenant structures. Areas requiring monitoring and maintenance include the discharges from the toe drain outlets, the infiltration of fines into the toe drain system, toe drain outlets, wet areas on the toe of embankment No. 2, and displaced riprap on the slopes of the principal spillway discharge channel.

The Farm Brook Dam has a storage capacity of 179 acre-feet at top of dam and is approximately 11 feet in height. Since the dam is within the Corps' criteria for small size category for storage (50 to 1,000 ac-ft), the dam is considered to be SMALL in size. The failure of the dam could potentially cause the loss of more than a few lives; therefore, the dam has been classified as having a HIGH hazard potential. In accordance with the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams" and as a result of the size classification (SMALL) and the hazard classification (HIGH) of the dam, the test flood will be between one-half the Probable Maximum Flood (1/2 PMF) and the Probable Maximum Flood (PMF). Since the project is within the lower limits of the small size category, the test flood will be equivalent to one-half of the Probable Maximum Flood (1/2 PMF). As a result, the peak inflow to the pond will be 1,290 cubic feet per second per square mile (cfs/sq. mi.) or 605 cubic feet per second (cfs) and the peak outflow will be 390 cfs. The combined capacity of the spillways, with the water surface at the top of the dam, is 610 cfs or 156 percent of the routed test flood outflow; therefore, no overtopping of the dam is anticipated.

It is recommended that the owner retain the services of a qualified registered professional engineer to investigate the condition of the principal spillway conduit and the sluice gate, determine the origin of the fines that have been conveyed through the toe drain system in embankment No. 2 and deposited in the impact basin, and determine if the diversion ditch berm has settled significantly. These recommendations and further remedial measures discussed in Section 7.3 should be instituted within one (1) year of the owner's receipt of this report.

R. A. Hokenson, P.E.

R. A. Hokenson, P.E.
Project Manager
International Engineering Company, Inc.

This Phase I Inspection Report on Farm Brook Dam (Site 1) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a

finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

Section	Page
Letter of Transmittal	
Brief Assessment	
Review Board Page	
Preface	i
Table of Contents	iii-v
Overview Photo	vi
Location Map	vii

REPORT

1. PROJECT INFORMATION	
1.1 General	
a. Authority	1-1
b. Purpose of Inspection	1-1
c. Scope of Inspection Program	1-1
1.2 Description of Project	1-2
a. Location	1-2
b. Description of Dam and Appurtenances	1-2
c. Size Classification	1-4
d. Hazard Classification	1-5
e. Ownership	1-5
f. Operator	1-5
g. Purpose of Dam	1-5
h. Design and Construction History	1-5
i. Normal Operational Procedures	1-6
1.3 Pertinent Data	1-6
2. ENGINEERING DATA	2-1
2.1 Design Data	2-1
2.2 Construction Data	2-1
2.3 Operation Data	2-1
2.4 Evaluation of Data	2-2

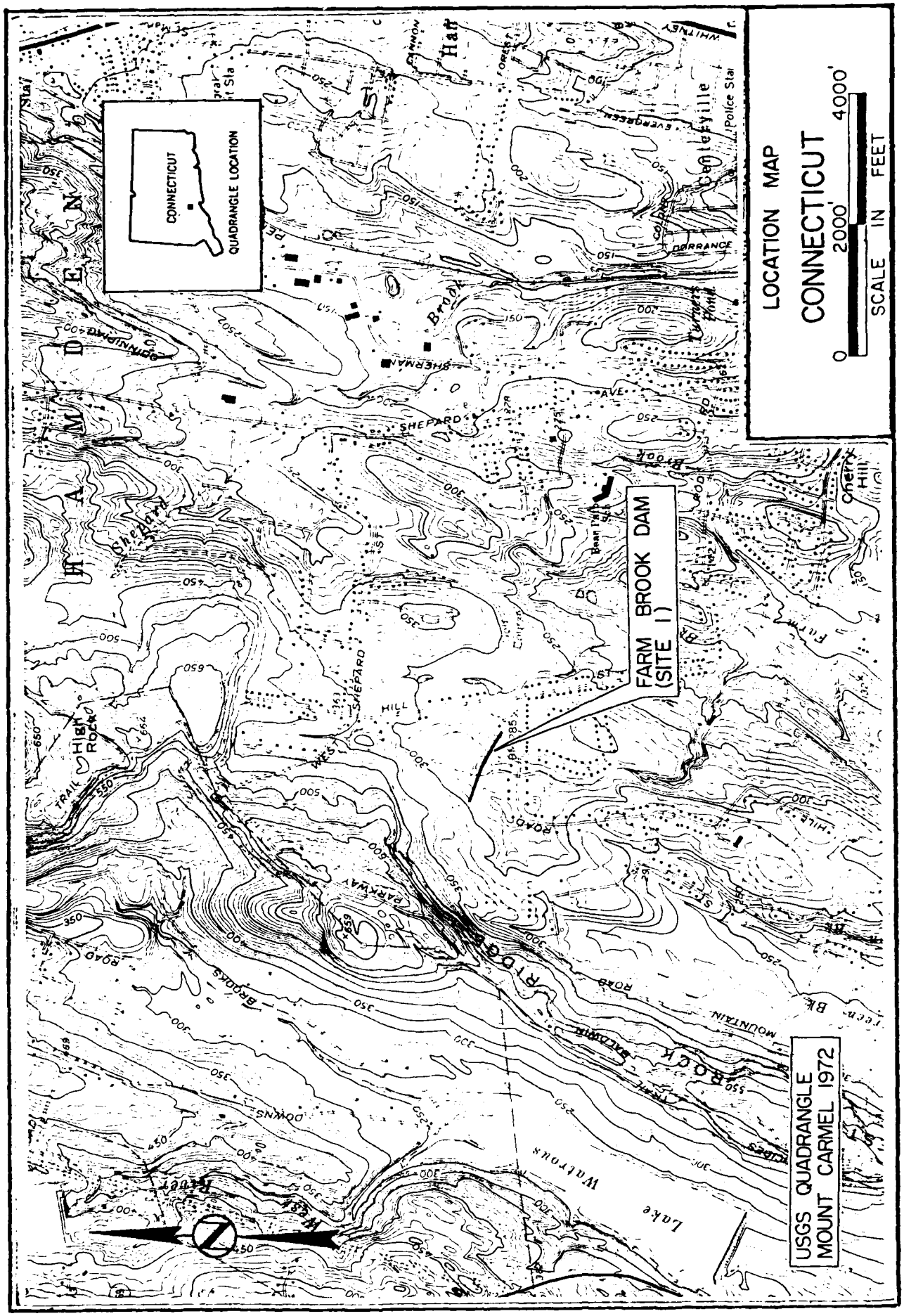
Section		Page
3.	VISUAL INSPECTION	3-1
	3.1 Findings	3-1
	a. General	3-1
	b. Dam	3-1
	c. Appurtenant Structures	3-2
	d. Reservoir Area	3-3
	e. Downstream Channel	3-3
	3.2 Evaluation	3-4
4.	OPERATIONAL AND MAINTENANCE PROCEDURES	4-1
	4.1 Operational Procedures	4-1
	a. General	4-1
	b. Description of any Warning System in Effect	4-1
	4.2 Maintenance Procedures	4-1
	a. General	4-1
	b. Operating Facilities	4-1
	4.3 Evaluation	4-2
5.	EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES	5-1
	5.1 General	5-1
	5.2 Design Data	5-1
	5.3 Experience Data	5-1
	5.4 Test Flood Analysis	5-2
	5.5 Dam Failure Analysis	5-2
6.	EVALUATION OF STRUCTURAL STABILITY	6-1
	6.1 Visual Observation	6-1
	6.2 Design and Construction Data	6-1
	6.3 Post-Construction Changes	6-1
	6.4 Seismic Stability	6-1

Section		Page
7.	ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES	7-1
7.1	Dam Assessment	7-1
	a. Condition	7-1
	b. Adequacy of Information	7-1
	c. Urgency	7-1
7.2	Recommendations	7-1
7.3	Remedial Measures	7-2
	a. Operation and Maintenance Procedures	7-2
7.4	Alternatives	7-3

APPENDIXES

APPENDIX A - INSPECTION CHECKLIST	A-1
APPENDIX B - ENGINEERING DATA	B-1
APPENDIX C - PHOTOGRAPHS	C-1
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	D-1
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	E-1

OVERVIEW PHOTO-FARM BROOK DAM
JANUARY 9, 1981


LOCATION MAP
CONNECTICUT
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SCALE IN FEET
CONNECTICUT
QUADRANGLE LOCATION
FARM BROOK DAM
(SITE 1)
USGS QUADRANGLE
MOUNT CARMEL 1972
SHEPARD
Lake Watrous
High Rock
Cherry Hill

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
FARM BROOK DAM (SITE 1)
SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority — Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England region. International Engineering Company, Inc., has been retained by the Corps' New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to International Engineering Company in a letter dated November 5, 1980, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-81-C-0015 has been designated by the Corps for this work.

b. Purpose of Inspection Program — The purposes of the program are to:

(1) Perform technical inspections and evaluations of non-Federal dams to identify conditions requiring correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program — The scope of this Phase I inspection report includes:

(1) Gathering, reviewing, and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments, and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The purpose of the inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF THE PROJECT

a. Location — The dam is located on Farm Brook in a residential area of the Town of Hamden, New Haven County, Connecticut, approximately 2 miles upstream from the confluence with West River. The dam is not shown on USGS quadrangle maps since the impoundment is relatively new and the USGS maps have not been updated since the construction of the dam in 1973. The location and watershed of Farm Brook Dam Site 1 have been identified on the Drainage Area Map in Appendix D. The location of the dam is defined by the coordinates latitude N41°23.7' and longitude W72°56.6' on the Mount Carmel, Connecticut, USGS Quadrangle Map.

b. Description of the Dam and Appurtenances — The dam, completed in 1973, consists of two earthfill embankments having a combined length of 1,115 feet, a concrete principal spillway conduit, and an unlined emergency spillway. The 535-foot-long embankment No. 1 and the 580-foot-long embankment No. 2 constitute the left and right portions of the dam,

respectively. The dam rises to a height of 11 feet above the streambed (elevation 291 NGVD) and is approximately 12 feet wide at the crest. (Note: All elevations are referenced to the National Geodetic Vertical Datum (NGVD).)

The inclination of the upstream and downstream slopes is three horizontal to one vertical. An 18-inch-thick layer of riprap has been placed on the upstream slope to within 2 feet of the top of the dam. A 3-foot-deep cutoff trench has been cut into the glacial till at the base of the dam. There is a 3-foot by 6.5-foot trench drain with a 6-inch perforated pipe at the base of the toe in both embankments. The drain outlet in embankment No. 1 has riprap slope protection. Embankment No. 2 has two drain outlets, which are located on the wing walls of the principal spillway outlet structure.

The principal spillway is located approximately 290 feet from the right abutment in embankment No. 2. The spillway is a drop inlet structure with a concrete riser intake, an 80-foot-long and 30-inch-diameter concrete conduit, a concrete impact basin, and a riprap-lined outlet channel. The riser forms a 2.5-foot by 7.5-foot drop inlet with a crest length of 15 feet at elevation 286. The intake is protected by steel trashracks, which are bolted onto the riser.

The 15-inch low-level outlet on the upstream wall of the riser has an invert elevation of 278.5. Flow through the outlet is regulated by a hand-operated sluice gate. The operator for the gate is located on top of the riser and is used to drain the pool via a conduit, which leads to a concrete impact basin. The outlet energy is contained and dissipated within the confines of the baffle and wing walls in the impact basin. The 130-foot-long and 12-foot-wide spillway outlet channel has a 2:1 slope inclination, which is protected by an 8-inch-thick gravel bedding overlain with 18 inches of riprap. The outlet channel has been excavated to elevation 277.0, adjacent to the principal spillway conduit, along the natural path of Farm Brook. Since the elevation of the top of the dam is

291.0, the dam is 14 feet high at the principal spillway. However, the remainder of the dam is only 11 feet high since the elevation of the natural ground surface is 280.0 (see Principal Spillway Section, Sheet B-1, Appendix B).

The emergency spillway, located between the embankments, has a bottom width of 35 feet, 3:1 side slopes, and a crest elevation of 288.2. The total length of the emergency spillway is 130 feet. This includes a 50-foot level section protruding into the impoundment. The spillway bottom and side slopes are completely sodded.

The diversion ditch, located on the right abutment of embankment No. 2 has a bottom width of about 3 feet and 1:1 side slopes; and the elevation of the bottom of the ditch, at the dam centerline, is 288.2. The ditch is formed by a natural rise on the right and a berm on the left. The elevation of the top of the berm (El. 291.25) was determined from the Soil Conservation Service design drawings. The ditch extends downstream of the dam and was constructed to collect surface runoff from the surrounding terrain and channel it into the impoundment. As a result, the grade of the channel bottom prohibits discharge through the ditch from the impoundment during flood conditions.

Approximately 55 feet from the toe of embankment No. 2, the principal spillway discharge channel is intersected by the drainage ditch, which collects runoff from the low area behind the dam. This ditch is about 3 feet wide at the bottom and has 2:1 side slopes that are covered by an 18-inch layer of riprap.

c. Size Classification - SMALL — The classification for size is based on the height of the dam above the natural streambed or the maximum storage potential, which is considered to be the storage resulting from the water surface elevation within the impoundment being equal to the elevation of the top of the dam. The size of the dam is then determined by either storage or height depending on which criteria yields the larger size category. Farm Brook Dam has a maximum potential storage capacity of 179

ac-ft, which is within the established limits for the small size category (50 ac-ft to 1,000 ac-ft), while the height of the dam (11 feet) is below the limits for the small size category (25 feet to 50 feet). Consequently, the dam is considered to be SMALL in size.

d. Hazard Classification - HIGH — The hazard classification is based on the estimated loss of life and the anticipated property damage due to a dam breach when the water surface within the impoundment is at the top of the dam. The failure of Farm Brook Dam (Site 1) would cause the water level within the impact area to rise from 7.6 feet at a prefailure outflow of 390 cfs to 13.0 feet after the failure. Consequently, the resulting flood would damage 11 homes and the bridge culvert at Dunbar Hill Road and could cause the loss of more than a few lives. Therefore, the dam has been classified as having a HIGH hazard potential.

e. Ownership — Department of Environmental Protection
State of Connecticut
165 Capital Avenue
State Office Building
Hartford, Connecticut 06115

f. Operator — Richard Miska
Unit Manager
Department of Environmental Protection
Sleeping Giant State Park
(203) 789-7498

g. Purpose of Dam — Recreation and flood control.

h. Design and Construction History — The dam was designed by the U.S. Department of Agriculture Soils Conservation Service and was constructed by the Nutmeg Construction Company, Inc. Farm Brook Dam (Site 1) was completed in 1973 and is currently used for flood control in the Farm Brook watershed.

i. Normal Operational Procedures — The low-level outlet gate is operated manually from the top of the concrete intake structure. The gate is opened, checked, and greased once a year. Mowing of the downstream slope and clearing of debris on the spillways and in the outlet channels are also performed annually. There is no formal operations manual describing the operation of the facility. The reservoir level is normally maintained at an elevation of 284. During flood conditions a representative from the Department of Environmental Protection is sent to ensure that the spillways remain free of obstructions.

1.3 PERTINENT DATA

a. Drainage Area — The drainage area encompasses 0.47 square miles of rolling terrain. The watershed may be described as a developed suburban area.

b. Discharge at Dam Site — Discharges from the pond are conducted via the 15-inch gated sluice opening in the principal spillway drop shaft, over the crest of the spillway riser, and over the crest of the emergency spillway. The discharge capacity of the various features are as follows:

(1) When the water surface is at the principal spillway crest (El. 286), the 15-inch sluice way (invert El. 278.5) will pass 45 cfs.

(2) The maximum known flood at the dam site was not determinable, since there are no flow or gage records maintained for Farm Brook.

(3) Ungated capacity of the principal spillway and emergency spillway is 610 cfs at elevation 291.

(4) Ungated combined spillway capacity at test flood elevation 290.2 is 380 cfs.

(5) Gated spillway capacity at normal pool elevation — N/A.

(6) Gated spillway capacity at test flood elevation — N/A.

(7) Total spillway capacity at test flood elevation 290.2 is 380 cfs.

(8) Total project discharge at top of dam (elevation 291) is 610 cfs.

(9) Total project discharge at test flood (elevation 290.2) is 380 cfs.

c. Elevations (feet above NGVD)

(1)	Original streambed at toe of dam	280.0
(2)	Bottom of principal spillway impact basin	277.0
(3)	Bottom of cutoff trench	274.0
(4)	Maximum tailwater	279.9
(5)	Normal pool (recreation)	286.0
(6)	Flood-control pool	288.2
(7)	Principal spillway crest	286.0
(8)	Emergency spillway crest	288.2
(9)	Design surcharge (original design)	289.0
(10)	Top of dam	291.0
(11)	Test flood surcharge	290.2

d.	Reservoir (length in feet)	
(1)	Normal pool (recreation)	1,000
(2)	Flood-control pool	1,100
(3)	Principal spillway crest pool	1,000
(4)	Emergency spillway crest pool	1,100
(5)	Top of dam	1,170
(6)	Test flood pool	1,160
e.	Storage (acre-feet)	
(1)	Normal pool	73
(2)	Flood-control pool	113
(3)	Principal spillway crest pool	73
(4)	Emergency spillway crest pool	113
(5)	Top of dam	179
(6)	Test flood pool	154
f.	Reservoir Surface (acres)	
(1)	Normal pool (recreation pool)	18.4
(2)	Flood-control pool	19.8
(3)	Principal spillway crest pool	18.4
(4)	Emergency spillway crest pool	19.8
(5)	Test flood pool	22.8
(6)	Top of dam	25.4

g.	Dam	
(1)	Type	Earthfill embankment
(2)	Length	1,210 ft
(3)	Height	11 ft
(4)	Top Width	12 ft
(5)	Side Slopes	3 H to 1 V upstream and downstream
(6)	Zoning	Homogeneous
(7)	Impervious Core	None
(8)	Cutoff	3-foot-deep cutoff trench
(9)	Grout Curtain	None
(10)	Other	6-inch drain pipe along dam toe
h.	Diversion and Regulatory Tunnel	N/A
i.	Spillways	
	Principal Spillway	
(1)	Type	Concrete drop inlet structure
(2)	Length of weir	2 by 7.5 ft
(3)	Crest elevation	286.0
(4)	Gates	None
(5)	U/S Channel	Farm Brook Pond
(6)	D/S Channel	Lined with riprap
(7)	General	The principal spillway outlet channel is 12 feet wide at the bottom and has 2H to 1 V side slopes.

Emergency Spillway

(1)	Type	Sodded channel
(2)	Length of weir	35 ft
(3)	Crest elevation	288.2
(4)	Gates	None
(5)	U/S Channel	N/A
(6)	D/S Channel	N/A
(7)	General	The spillway is 35 feet wide with 3 H to 1 V slopes.

j. Regulating Outlets — The only regulating outlet is a low-level opening in the upstream wall of the riser.

(1)	Invert Elevation	278.5
(2)	Size	15-inch diameter
(3)	Description	Bench stand with handwheel
(4)	Control Mechanism	Hand-operated sluice gate
(5)	Other	The outlet diversion works consists of a 30-inch-diameter and 80-foot-long concrete conduit.

SECTION 2: ENGINEERING DATA

2.1 DESIGN DATA

A design report was obtained from the U.S. Department of Agriculture Soil Conservation Service, and the design drawings were borrowed from the State of Connecticut Water Resource Department. The calculations within the design report deal primarily with the hydraulics of the emergency and principal spillways. However, the geology and soil testing reports and excerpts from the embankment design calculations were also included in the report.

2.2 CONSTRUCTION DATA

a. Available Data — "As-built" drawings and construction records are on file at the U.S. Department of Agriculture Soil Conservation Service, Storrs, Connecticut.

b. Construction Considerations — The dam was originally designed along an alignment which permitted both shallow water for skating and deeper water for boating and swimming. However, the high costs of obtaining land rights necessitated the relocation of the dam farther upstream. The foundation investigation of the new alignment dictated an additional movement of the right abutment in an upstream direction. This relocation was performed to facilitate construction.

2.3 OPERATION DATA

No written operation and maintenance manual is available for this project, however, an operations and maintenance agreement was signed by the owner, the State of Connecticut Department of Environmental Protection (DEP), with the designer, the U.S. Department of Agriculture Soil Conservation Service (SCS). This agreement contains the requirements for annual inspections and the items to be checked for possible maintenance needs. According to the DEP maintenance of the facility is normally performed and includes mowing, clearing debris, and servicing the low-level outlet gate.

2.4 EVALUATION OF DATA

a. Availability — Data was provided by the dam owner (Department of Environmental Protection), the designer (U.S. Department of Agriculture Soil Conservation Service), and the State of Connecticut Water Resource Department.

b. Adequacy — Detailed hydrologic/hydraulic data were available and used to compute the spillway capacity. The final assessment of the dam was based primarily on visual inspection, performance history, and spillway capacity computations.

c. Validity — The field inspection indicated that the external features of the Farm Brook Dam (Site 1) coincide with those shown on the available plans.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General — The field inspection of Farm Brook Dam (Site 1) was conducted on December 5, 1980. At the time of the inspection, the water surface was 3.3 feet below the top of the spillway riser, which corresponds to a water surface elevation of 283.9. The inspection team consisted of personnel from International Engineering Company (IECO) and a DEP representative from the Sleeping Giant State Park.

b. Dam — The dam is a compacted earthfill embankment. No sloughing or erosion of the embankments was noted.

(1) Top — The top of the dam is primarily grass covered with the exception of a narrow footpath extending the length of the dam (Photos 1 and 2). The uniform elevation of the top of the dam is only interrupted by the emergency spillway. Neither abutment showed signs of deterioration or erosion. The diversion ditch on the right abutment of embankment No. 2 (Photo 11) was dry, and there were no indications of any recent flow through the ditch. The portion of the berm immediately downstream of the dam appeared to have settled; and as a result, the top of the berm was no longer above the top of the dam (Photo 2).

(2) Upstream Slope — The upsteam slope (Photo 1) has riprap protection starting about 2 feet below the top of the dam. There was no sign of excessive riprap displacement, erosion, or bulging. The continuity of the upstream slope is maintained across the entire dam.

(3) Downstream Slope — The downstream slope is entirely grass covered (Photo 2). There are three narrow footpaths on the slope, but no significant signs of trespassing. Discharges of 17 gallons per minute (gpm) and 6 gpm were recorded from the right

and left toe drain outlets in embankment No. 2, respectively (Photo 7). The difference in the amount of flow through each drain may be due to the right toe drain being longer than the left, the average head on the right portion of the embankment being greater than on the left, or the permeability of the material composing the right portion of the embankment being greater than that of the left. The toe drain outlet in embankment No. 1 has been obstructed by an accumulation of top soil that has presumably been eroded from between the stones above the outlet (Photo 5). No flow was observed in the drain outlet channel, since the grade of the channel no longer permits proper drainage. It was also noted that the toe drains in embankment No. 2 were conveying fines from the interior of the dam to the impact basin. The origin of this material may be a dirty or improperly placed filter. However, the deposit of fines may also be the result of increased seepage through the embankment and, therefore, requires further investigation. In addition, the exposed portions of the steel toe drains were rusted and pitted.

The low area adjacent to the toe of embankment No. 2 in the vicinity of the drainage ditch is marshy. The discharge from this ditch was estimated to be 5 gpm (Photo 3). It was evident from the design drawings that this ditch was intended to drain the low area behind embankment No. 2.

c. Appurtenant Structures — The principal spillway riser is in relatively good condition with no visible concrete deterioration. Corrosion was noted on the steel trashracks, but only within the zone of water surface variation. The control mechanism for the low-level outlet gate was slightly bent and the steel support plate cracked; but according to the DEP representative, the device was still operable.

Deterioration of the concrete impact basin was negligible. Slight superficial cracks were noted near the fence post anchorages, but no significant amounts of spalling were observed. Rocks and debris were found in the basin (Photo 7). During the inspection, the sluice gate on the principal spillway conduit was closed and there seemed to be no flow through the conduit into the impact basin. However, it was difficult to determine the effectiveness of the sluice gate seal because of the discharge from the toe drain outlets into the impact basin. The riprap lining in the principal spillway discharge channel was displaced and exposed the gravel bedding in some areas, but no other signs indicating erosion or deterioration were noted on the slopes of this discharge channel. The drainage ditch outlet on the right side of the spillway channel was also in relatively good condition.

The side slopes and bottom of the emergency spillway were completely sodded and there were no indications of erosion or instability (Photo 9). The groundcover within the spillway was only interrupted by a narrow footpath. The riprap along the edges of that portion of the spillway which is exposed to wave action within the pond was intact. There was also no significant accumulation of debris within the structure; however, one empty steel drum was found on the emergency spillway crest.

d. Reservoir Area — The area surrounding the reservoir is largely residential with the exception of a rolling field adjacent to the right abutment of the dam.

e. Downstream Channel — The downstream channel follows the natural path of Farm Brook. The channel has a bottom width of 10 feet, is 6 feet deep, and has side slopes of approximately 2:1. The channel bed is inclined at a 20:1 slope within the 500-foot reach immediately downstream of the dam. Farm Brook flows through two steel conduits, which form a bridge culvert at Dunbar Hill Road. One conduit, 3.5-foot-high by 5.5-foot-wide, is relatively new and is not aligned properly. As a result, it somewhat inhibits drainage. However, the original 2.5-foot-high by 3.5-foot-wide conduit has a desirable slope.

Large quantities of debris were found in and around the streambed. Numerous trees and bushes were observed to be both growing in and hanging over the channel (Photo 10).

3.2 EVALUATION

Based on the visual inspection of Farm Brook Dam (Site 1), it has been determined that the structure is in generally fair condition. The following features, which could influence the condition and/or stability of the dam in the future, were identified:

(1) The larger discharge recorded from the right toe drain system in embankment No. 2 may be due to the right toe drain being longer than the left, the average head on the right portion of the embankment being greater than on the left, or the permeability of the material composing the right portion of the embankment being slightly greater than that of the left.

(2) The restriction of flow from the toe drain outlet in embankment No. 1 is causing localized saturation of the downstream toe.

(3) The abrasive action of the rocks, stones, and debris on the bottom of the impact basin during periods of high discharge will cause accelerated deterioration of the baffle and wing walls. The deterioration of the impact basin will eventually decrease the structure's ability to effectively function as an energy dissipator.

(4) The displaced riprap and exposed filter layer, on the slopes of the principal spillway outlet channel, invite the erosion of the channel slopes.

(5) The fines found in the toe drain outlets of embankment No. 2 may be the result of a dirty or improperly placed filter layer.

However, there is also the possibility that these deposits are due to excessive seepage resulting in the movement of fine soil particles within the dam. Consequently, it has been recommended in Section 7.2 that the origin of this material be identified.

(6) The effectiveness of the sluice gate could not be assessed due to the discharge of the toe drains into the impact basin. This discharge created enough turbulence within the pool contained in the impact basin so as to conceal any evidence of leakage from the gate through the principal spillway outlet conduit. Therefore, it has been recommended in Section 7.2 that the condition of the gate and conduit be thoroughly assessed.

(7) The corroded portions of the toe drain outlet pipes in the impact basin may impair discharge.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General — The dam is used for flood control in the Farm Brook watershed. The low-level outlet is used to regulate the water surface within the impoundment to facilitate recreation in the pond, draw down the pond to repair the upstream slope when necessary, and/or maintain a relatively dry basin to achieve maximum flood storage. The facility was designed to automatically pass a flood while minimizing the impact downstream. When the pond surface reaches the principal spillway crest (El. 286), this outlet will begin to discharge the accumulated runoff. If the water surface continues to rise and reaches the emergency spillway crest (El. 288.2), then this structure will supplement the discharge of the principal spillway.

b. Description of any Warning System in Effect — There is no formal written downstream warning system in effect at Farm Brook Dam (Site 1).

4.2 MAINTENANCE PROCEDURES

a. General — All inspection and maintenance procedures are instituted by the owner and performed annually. The facility is visually inspected for obstructions in the spillways and for vandalism by a state dam inspector, a regional representative, and a representative from the Soil Conservation Service. Prior to the completion of the inspection, a report containing the findings and recommendations of the inspection team is filed with the State of Connecticut Department of Environmental Protection. The only regularly scheduled maintenance of the dam is mowing of the grass on the embankment. Currently, there is no operations manual for the site, but an operations and maintenance agreement was signed by the owner (DEP) with the designer (SCS). This agreement contains the requirements for annual inspections and items to be checked for possible maintenance needs.

b. Operating Facilities — The low-level outlet gate is greased and checked annually.

4.3 EVALUATION

The operation and maintenance procedures currently employed at the site are fair. Maintenance of the site should be scheduled regularly and periodic inspections continued. Records documenting the operation of the facility should be kept for future reference. In addition, a formal written downstream warning system and operation plan should be established. Remedial measures and maintenance recommendations are presented in Section 7.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The dam was constructed to impound water for flood control purposes. The combined capacity of the concrete drop inlet principal spillway and emergency spillway is fairly large with respect to the watershed and will pass 156 percent of the project test flood outflow without overtopping the dam.

The dam and appurtenant structures appear to be sound. The spillway channel and emergency spillway do not have any substantial obstructions; however, tall grass was observed in the emergency spillway and along the outlet channels. The low area at the right abutment of the embankment is a construction diversion ditch, which extends downstream of the dam. The ditch has a bottom elevation of 288.2 and side slopes of about 1:1.

5.2 DESIGN DATA

Available design data were obtained from the design report prepared by the U.S. Department of Agriculture Soil Conservation Service titled "Farm Brook Watershed Project", 1972 (see Appendix B, "Engineering Data and Correspondence"). The design high water was calculated, in the design report, using a 100-year, 6-hour duration storm with a peak inflow of 665 cfs. The resulting water surface elevation within the impoundment was 289.0, and the peak outflow was 120 cfs (see Appendix B).

5.3 EXPERIENCE DATA

No information indicating serious problems with the dam was uncovered. Based on the visual inspection, it does not appear that the dam has been overtopped or the emergency spillway used.

5.4 TEST FLOOD ANALYSIS

The maximum potential storage capacity of Farm Brook Dam (Site 1) (179 ac-ft) is within the lower limits of the small size category and the height of the structure (11 feet) is smaller than the height criteria established by the Corps in the "Recommended Guidelines for Safety Inspection of Dams", dated September 1979, for the small size category. The hazard classification for the dam is high, since there is the potential for the loss of more than a few lives due to the breach of the dam. Based on the storage capacity, height, and hazard, the recommended test flood for this dam is between one-half the Probable Maximum Flood (1/2 PMF) and the Probable Maximum Flood (PMF). The test flood was chosen as one-half the Probable Maximum Flood (1/2 PMF). The peak inflow to the reservoir due to this flood in a 0.47 sq. mi. rolling watershed is 1,290 cfs/sq. mi. The inflow due to the test flood (605 cfs) and the outflow (390 cfs) will cause the water surface elevation within the impoundment to rise to 290.2 or 0.8 feet below the top of the dam. The combined capacity of the principal and emergency spillways is 610 cfs with the water surface at the top of the dam (El. 291.0) or 156 percent of the routed test flood outflow.

5.5 DAM FAILURE ANALYSIS

Utilizing the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, the failure outflow was calculated to be 7,200 cfs with the water surface within the impoundment at the top of the dam. The dam failure was assumed to occur in embankment No. 2; however, the breach width was adjusted to 0.25 L instead of the recommended 0.4 L. This new breach width was used since the recommended value yielded a water surface elevation within the impact area, after failure, that exceeded the elevation of the top of the dam. Therefore, the

breach width was reduced to 107 feet. It was assumed that the breach includes the principal spillway; however since this structure is independent of the embankment, the discharge from it at the time of failure was included in the outflow due to the dam breach.

The failure of Farm Brook Dam (Site 1) will cause the water surface within the downstream channel to rise from 7.6 feet at a prefailure outflow of 610 cfs to 13.0 feet at a failure outflow of 7,200 cfs. As a result, the breach of the dam would damage 11 homes and the bridge culvert at Dunbar Hill Road and could cause the loss of more than a few lives. Therefore, the dam has been classified as having a HIGH hazard potential.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION

The visual inspection did not reveal any indications of stability problems that might require immediate attention or are considered to be significant at the present time. However, the fines that are being conveyed by the toe drain system in embankment No. 2 may be an indication of the internal deterioration of the embankment and/or the result of a dirty filter. An investigation of this should be conducted as recommended in Section 7.2.

6.2 DESIGN AND CONSTRUCTION DATA

The available design drawings and data from the Farm Brook Watershed Project design report are listed in Appendix B. The embankment stability was calculated within the design report using the Swedish Circle Method. Assuming a full drawdown condition, this analysis yielded a factor of safety of 2.3. According to the Corps guidelines, a circular failure surface is generally applicable to essentially homogeneous embankments and the resulting factor of safety should be no less than 1.2. Foundation drain and seepage analysis conducted during the design study determined a total seepage discharge of 451 cubic feet per day or 2.35 gallons per minute. As-built drawings were prepared and are available at the Soil Conservation Service office in Storrs, Connecticut. There have been no indications of dam instability since its construction in 1973.

6.3 POST-CONSTRUCTION CHANGES

There were no records available concerning any post-construction changes of the dam.

6.4 SEISMIC STABILITY

The dam is in Seismic Zone 1 and, in accordance with the Recommended Guidelines, does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition — Based upon the visual inspection and past performance, the dam appears to be in fair condition. No evidence of structural instability was observed in the dam, principal spillway, or appurtenant structures. The earthfill embankment is in generally good condition. There are, however, areas of some concern that require maintenance and monitoring.

Based upon "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, and hydraulic/hydrologic computations, the peak inflow to the reservoir during the test flood is 605 cfs and the peak outflow is 390 cfs. These flows will not result in the overtopping of the dam. Based upon hydraulic computations, the combined spillway capacity is 610 cfs, which is equivalent to approximately 156 percent of the routed test flood outflow.

b. Adequacy of Information — The information available on the structure is limited. Thus, the assessment of the condition and stability of the dam must be based largely on visual inspection, past performance, and sound engineering judgement.

c. Urgency — It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within one (1) year of the owner's receipt of this report.

7.2 RECOMMENDATIONS

It is recommended that the owner employ a qualified registered professional engineer to:

(1) Investigate and evaluate the condition of the concrete spillway conduit and the sluice gate.

(2) Determine the origin of the seepage and the fines that have been passing through the toe drain system in embankment No. 2 and evaluate the severity of the problem.

(3) Investigate the possible settlement of the berm that forms the left bank of the diversion ditch and determine the effect of the discharge over this portion of the berm on the toe of the dam.

The owner should implement the recommendations of the Engineer.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures — The following measures should be undertaken within one (1) year of the owner's receipt of this report and continued on a regular basis.

(1) A formal program of operation and maintenance procedures should be instituted and documented to provide accurate records for future references.

(2) The drain outlet channel of embankment No. 1 should be cleared of obstructions and the bottom of the channel should be graded to facilitate drainage.

(3) The baffle apron floor of the principal spillway should be cleared of stones to avoid premature deterioration of the baffle and wing walls due to the abrasive action of the stones during periods of high discharge.

(4) The exposed slope areas of the riprapped spillway channel should be repaired and any obstacles on the spillway channel floor should be removed.

(5) The broken steel support plate on the sluice gate stand should be repaired.

(6) The corroded steel drain pipe outlets and portions of the trash-racks on the principal spillway riser should be restored during a routine maintenance visit.

(7) The cutting of grass on the top, slopes, and toe of the dam and in the emergency spillway should be continued as part of the routine dam maintenance.

(8) Debris and trees in the downstream channel should be cleared.

(9) An "Emergency Action Plan" should be developed that will include an effective preplanned downstream warning system; locations of emergency equipment, materials, and manpower; authorities to contact; and potential areas that require evacuation.

(10) The annual technical inspection program currently in effect at the site, as described in Section 4.2, should be continued.

7.4 ALTERNATIVES

There are no practical alternatives to the recommendations of Sections 7.2 and 7.3.

APPENDIX A

VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECKLIST

PARTY ORGANIZATION

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

TIME: 10:30 a.m.

WEATHER: Clear, Cold, 32°F

W.S. ELEV. 284.6 U/S _____ DN/S.

PARTY:	INITIALS:
1. Carol H. Cunningham	CC
2. Reynold A. Hokenson	RH
3. Miron B. Petrovsky	MP
4. Ernst H. Buggisch	EB

PROJECT FEATURE		INSPECTED BY
1. Embankments No. 1 and No. 2		RH, CC, MP, EB
2. Principal Spillway:		
	Intake	CC, MP, EB
	Conduit	RH, MP
	Outlet Structure and Outlet Channel	RH, MP
3. Emergency Spillway		RH, CC

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

PROJECT FEATURE: Embankments 1 and 2 NAME: RH, CC, MP, EB

AREA EVALUATED	CONDITION
DAM EMBANKMENT:	
Crest Elevation	291.0
Current Pool Elevation	284.6
Maximum Impoundment to Date	286.1
Surface Cracks	None Visible
Pavement Condition	N/A
Movement or Settlement of Crest	None Apparent
Lateral Movement	None Apparent
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good, diversion ditch on right abutment
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Foot paths along crest and downstream slope
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	Wet area near toe of embankment No. 2
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	Embankment No. 1 - drainage impaired
Toe Drains	Embankment No. 2 - flowing freely, total flow of 23 gpm
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

PROJECT FEATURE: NAME:

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	N/A
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	N/A
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

PROJECT FEATURE: Principal Spillway Intake NAME: CC, MP, EB

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	None Visible
Spalling	None
Visible Reinforcing	None
Rusting or Staining of Concrete	Minor, near trash rack bolts
Any Seepage or Effloresence	Could not inspect interior of structure
Joint Alignment	Inaccessible
Unusual Seepage or Leaks in Gate Chamber	Inaccessible
Cracks	None
Rusting or Corrosion of Steel	Trashracks at and below water line
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A
Service gates	Slightly bent gate stand and cracked support plate
Emergency Gates	N/A
Lighting Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site DATE: 12/05/80

PROJECT FEATURE: Principal Spillway Outlet NAME: RH, MP

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Interior portions of spillway and the outlet conduit within the dam were inaccessible.
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site DATE: 12/05/80

PROJECT FEATURE: Principal Spillway Outlet Structure and Outlet Channel NAME: RH, MP

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good, minor cracking at fence posts
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain Holes	Toe drain outlet from Embankment No. 2
Channel	
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Fair, some areas of displaced riprap and exposed filter layer
Downstream Channel	The downstream channel of Farm Brook has numerous trees and bushes growing within and along the banks. No maintenance of this area is currently performed. The brook flows under Dunbar Hill Road through two steel culverts. The larger culvert is misaligned and, as a result, restricts flow.

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

PROJECT FEATURE: Emergency Spillway NAME: RH, CC

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	One steel drum among tall grass
b. Weir and Training Walls	Grass covered earth weir in good condition
General Condition of Concrete	N/A
Rust or Staining	N/A
Spalling	N/A
Any Visible Reinforcing	N/A
Any Seepage or Effloresence	N/A
Drain Holes	N/A
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Covered with tall grass
Other Obstructions	Undeveloped wooded area at end of channel near downstream channel confluence

PERIODIC INSPECTION CHECK LIST

PROJECT: Farm Brook Dam Site 1 DATE: 12/05/80

PROJECT FEATURE: NAME:

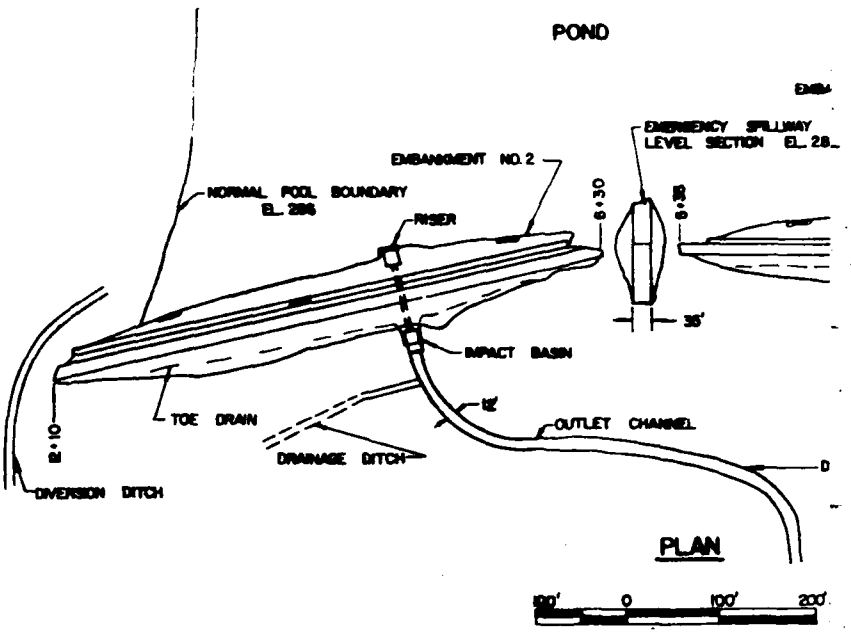
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. SuperStructure	N/A
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	N/A
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

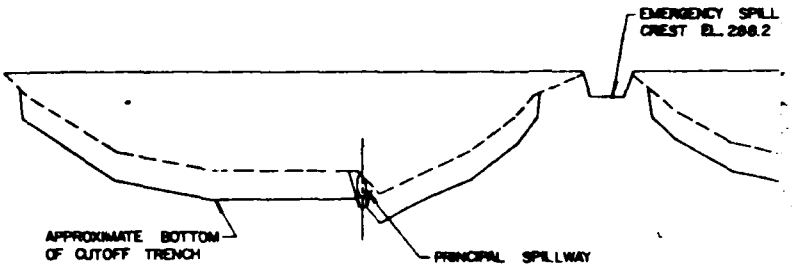
APPENDIX B

ENGINEERING DATA

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
3/81	---	---	Plan, Profile, and Sections	B-2
	---	Connecticut DEP	Water Resource Inventory Data Sheet	B-3
8/23/79	---	Connecticut DEP	Water Resource Operation and Maintenance Inspection Report	B-4
1968	---	USDA Soil Conservation Service	Excerpts from Farm Brook Design Report	B-5



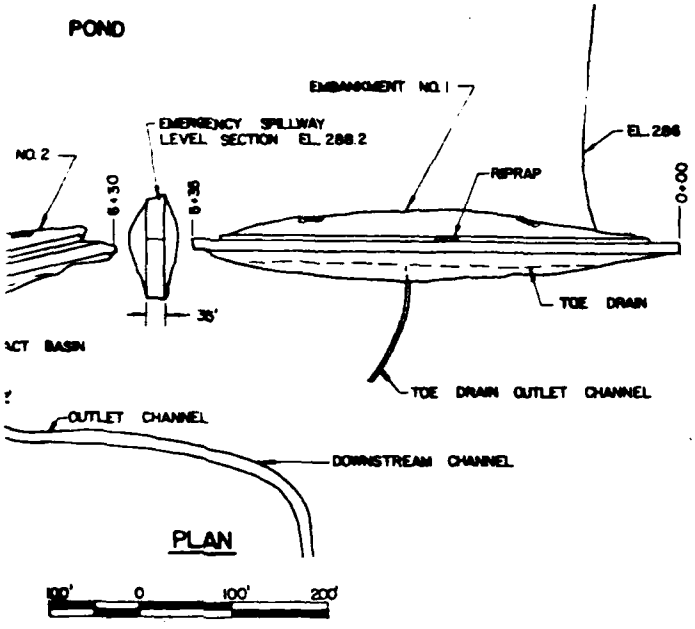


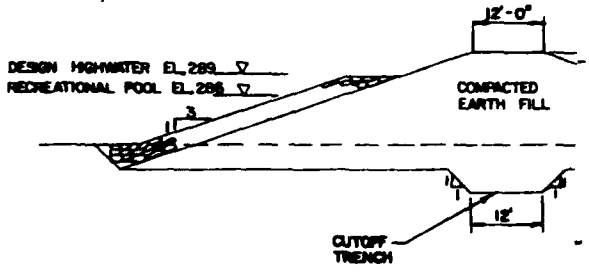
PROFILE ALONG ℄ OF D

VERTICAL SCALE 10' 0

HORIZONTAL SCALE 100' 0

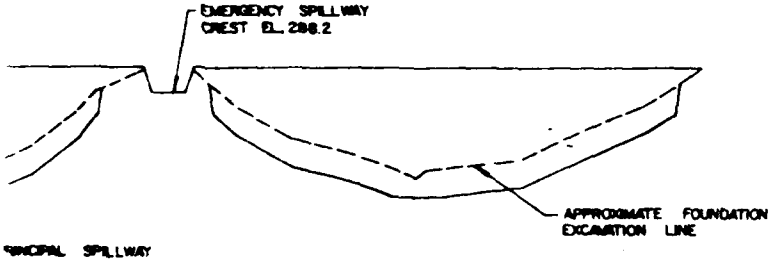
(1)





TYPICAL EMBANKMENT

NOT TO SCALE

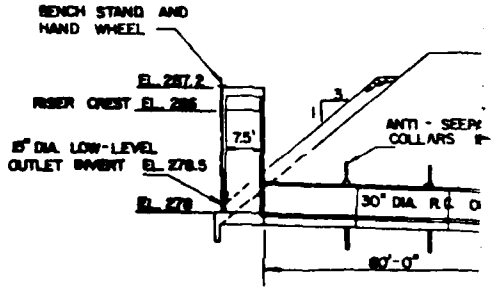


PRINCIPAL SPILLWAY

PROFILE ALONG ℄ OF DAM

VERTICAL SCALE 10' 0 10' 20'

HORIZONTAL SCALE 100' 0 100' 200'



PRINCIPAL SPILLW

VERTICAL SCALE:

HORIZONTAL SCALE 20'

NOTES:

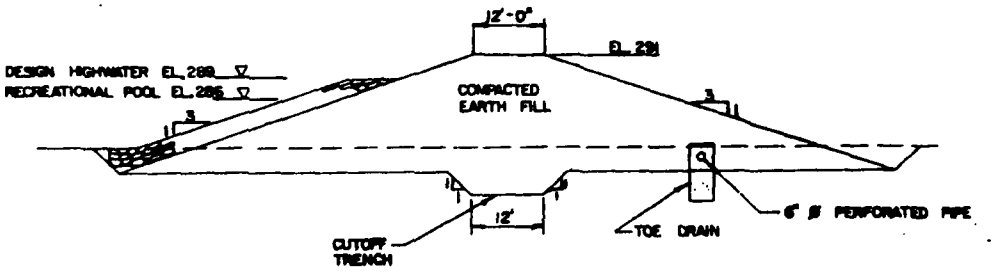
1. THIS PLAN WAS COMPILED FROM THE EXISTING DESIGN DRAWINGS BY THE DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE (1968) AND SUPPLEMENTARY FIELD OBSERVATION MADE BY IECO ENGINEERS.

2. NO N.G.V.D. ELEVATIONS WERE AVAILABLE FOR THE DAM. ALL ELEVATIONS ARE FROM THE SOIL CONSERVATION SERVICE DESIGN DRAWINGS WHICH WERE REFERENCED TO M.S.L.D.

INTERNATIONAL
DARIEN, CT
ENGI
NATIONAL PI

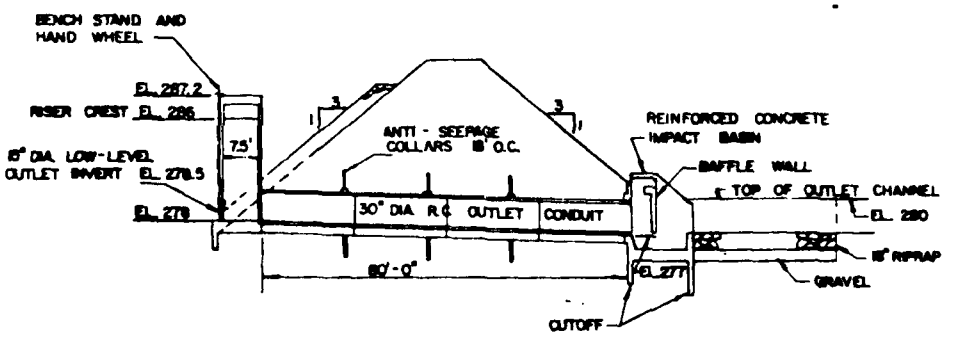
FARM BROOK

DRAWN BY	CHE
P ARCHER	E.B



TYPICAL EMBANKMENT CROSS SECTION

NOT TO SCALE



PRINCIPAL SPILLWAY SECTION

VERTICAL SCALE: 8' 0 8' 16'

HORIZONTAL SCALE 20' 0 20' 40'

NOTES

1. THIS PLAN WAS COMPILED FROM THE EXISTING DESIGN DRAWINGS BY THE DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE (1968) AND SUPPLEMENTARY FIELD OBSERVATION MADE BY IECO ENGINEERS.
2. NO N.G.V.D. ELEVATIONS WERE AVAILABLE FOR THE DAM ALL ELEVATIONS ARE FROM THE SOIL CONSERVATION SERVICE DESIGN DRAWINGS WHICH WERE REFERENCED TO M.S.L.D.

INTERNATIONAL ENGINEERING CO DAREN, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

PLAN, PROFILE AND SECTIONS

FARM BROOK DAM (SITE 1) (3)

FARM BROOK — HAMDEN, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
P ARCHER	E BUSSIERE	R HOKENSON	DATE MARCH 1981	SHEET 8-1

SUPERVISION OF DAMS
INVENTORY DATA

21
CT 657

Inventoried
By _____

Date _____

Name of Dam or Pond FARM BROOK PROJECT SITE #1

Code No. _____

Nearest Street Location DUNBar Hill Road

Town HAMDEN LAT. 41°23.7'

U.S.G.S. Quad. Mt. Carmel LONG. 72° 56.6'

Name of Stream FARM BROOK

Owner D.E.P.

Address _____

DA 0.475M

Pond Used For Multiple Purpose - flood control & Rec

Dimensions of Pond: Width _____ Length _____ Area 18 Acres

Total Length of Dam 1250 ft. Length of Spillway 40 ft - 30" D. pr. emerg

Location of Spillway ℄ of dam

Height of Pond Above Stream Bed 10' ft

Height of Embankment Above Spillway 4' ft

Type of Spillway Construction Drop Inlet w- grass emergency

Type of Dike Construction Earthen Fill

1974

Downstream Conditions Street - wooded area - Residential

Summary of File Data data taken from plans

Remarks _____

DA = 301 Ac.

Would Failure Cause Damage? yes Class _____

Start [illegible] 12 [illegible] 110 [illegible]

WATER RESOURCES UNIT - D.E.P.

OPERATION AND MAINTENANCE INSPECTION REPORT

PROJECT: Hamden - Farm Brook Site 1 DATE: August 23, 1979

INSPECTION PARTY: T. Myers, Soil Conservation Service, R. Miska and V. Galgowski, Department of Environmental Protection

ITEM	CONDITION S or U*	MAINTENANCE OR REPAIRS REQUIRED	DATE COMPLETED
I. Embankments			
A. Vegetation	S	Mow grass	
B. Rip rap	S	Remove brush	
C. Drains	S		
II. Principal Spillway			
A. Trash rack	S	Remove logs	
B. Gates	S		
C. Stilling basin	S		
D. Conduit	S		
III. Emergency Spillway			
A. Vegetation	S		
B. Obstructions	S		
IV. Outlet Channels			
A. Slope protection	S		
B. Debris	S	Remove rip rap from channel	
V. Reservoir Area			
A. Debris	S		
B. Stop logs	N/A		
VI. Miscellaneous			
A. Access road	S		
B. Fences	S		

Remarks: Rip rap on upstream slope in the vicinity of riser should be restored.

IECO
Eastern District
JAN 17 '81
C-
To A
EHR

Inspected by: Victor F. Galgowski Title Supt. of Dam Maintenance

* S = Satisfactory
U = Unsatisfactory
NA = Not applicable

DESIGN REPORT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

INDEX

I - GENERAL

II - HYDRAULIC DESIGN

III - FOUNDATION & EMBANKMENT DESIGN

A- GEOLOGY REPORT

B- SOIL TESTING REPORT

C- ANALYSIS

IV - STRUCTURAL DESIGN

V - LAYOUT

VI - QUANTITIES

VII - SPECIFICATIONS

CONNECTICUT STATE OFFICE
STORRS, CONN.

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

This multiple-purpose dam is located about 2.5 miles northwest of Hamden, Connecticut on a tributary of Farm Brook. Sheet 4 of this report, together with Mount Carmel, Conn., 7.5-minute quadrangle, published by the U.S. Geological Survey, may be used to locate the structure more definitely.

A summary of pertinent design information is given on sheet 2 of this report.

This is one of two proposed floodwater retarding dams in the Farm Brook Watershed designed to reduce floodwater damages. It will retard a 100-year frequency storm without discharge occurring in the emergency spillway. The permanent pool has a water surface area of 18 acres and a beneficial storage volume of 73 acre-feet in addition to the 50-year sediment storage.

The results of hydrologic and hydraulic computations are given on sheet 3 of this report.

The structure consists of a compacted earth fill with partial cutoff into a more dense glacial till underlying the surface sands and organic materials which are to be removed. A drainage system is located under the downstream portion of the earth fill to control the phreatic surface and to collect subsurface seepage.

The principal spillway is a drop inlet structure consisting of a single-stage reinforced concrete riser, 30-inch diameter reinforced water pipe conduit, and a reinforced concrete impact basin to dissipate the energy of high velocity discharge at the outlet end of the conduit.

The emergency spillway is designed as a vegetated earth cut through a knoll between embankments 1 and 2.

The dam was initially designed along an alignment which permitted both shallow water for skating and deeper water for swimming and boating. High costs of necessary land rights necessitated the relocation of the dam upstream. The foundation investigation of the new alignment dictated an additional movement upstream of the right abutment. This additional relocation was to facilitate construction.

CONNECTICUT STATE OFFICE, STORRS, CONN.

U.S. DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE

DESIGN REPORT SUMMARY

WATERSHED DATA

DRAINAGE AREA		
IMMEDIATELY ABOVE SITE	244	AC.
SUBWATERSHEDS ABOVE SITE	-	AC.
TOTAL WATERSHED	244	AC.
TIME OF CONCENTRATION, T_c	0.5	HR.
HYDROLOGIC CURVE NUMBER, CN		
MOISTURE CONDITION II	73	
MOISTURE CONDITION III	-	

PRINCIPAL SPILLWAY

CONDUIT		
SIZE (I.D.)	30	IN.
LENGTH	80	FT.
RISER		
SIZE (INSIDE DIMENSIONS)	2.5' X 7.5'	FT.
HEIGHT (FLOOR TO CREST)	8	FT.
WEIR LENGTH	15	FT.
ORIFICE SIZE	-	FT.
POND DRAIN SIZE	15	IN.
TYPE OF OUTLET ENERGY DISSIPATOR	Impact Basin	

EMERGENCY SPILLWAY

TYPE	Earth	
WIDTH	35	FT
SIDE SLOPES	3:1	
LENGTH OF LEVEL SECTION	40	FT
EXIT CHANNEL SLOPE	0.04	FT/FT
VELOCITY OF FLOW AT CONTROL SECTION*	3.5	FT/SEC
DURATION OF FLOW*	5.4	HR.
FREQUENCY OF USE*	1%	

EMBANKMENT

DAM		
MAX. HEIGHT	12	FT.
LENGTH	600	FT.
VOLUME OF FILL	5700	C.Y.
DIKE		
MAX HEIGHT	12	FT
LENGTH	550	FT.
VOLUME OF FILL	7800	C.Y.

* Based upon reservoir stage at design high water elevation

CONNECTICUT STATE OFFICE, STORRS, CONN.

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

HYDROLOGIC CRITERIA AND ROUTING RESULTS

ELEMENT OF STRUCTURE	DETERMINING FACTOR	ELEVATION	SURFACE AREA ACRES	STORAGE		INFLOW		PEAK OUTFLOW C. F. S.
				ACRE-FEET	INCHES*	VOLUME INCHES	PEAK RATE C. F. S.	
INVERT OF ORIFICE	-	-	-	-	-	-	-	-
CREST OF RISER	Recreation Pool	286,0	18	73	3.60	-	-	-
CREST OF EMERGENCY SPILLWAY	100-year, 10-day Storm, with baseflow, AMC II	288.2	20	41 1/	2.04 1/	7.55	406	70
DESIGN HIGH WATER	100-year, 6-hour storm, AMC II	289.0	21	58 1/	2.86 1/	4.37	665	121
TOP OF DAM	Design High Water 2/ elevation plus 2'	291.0	25	106 1/	5.22 1/	9.62 3/	1468 3/	465 3/

* Volume expressed in inches of runoff from controlled watershed of 244 acres.

1/ Does not include recreation storage

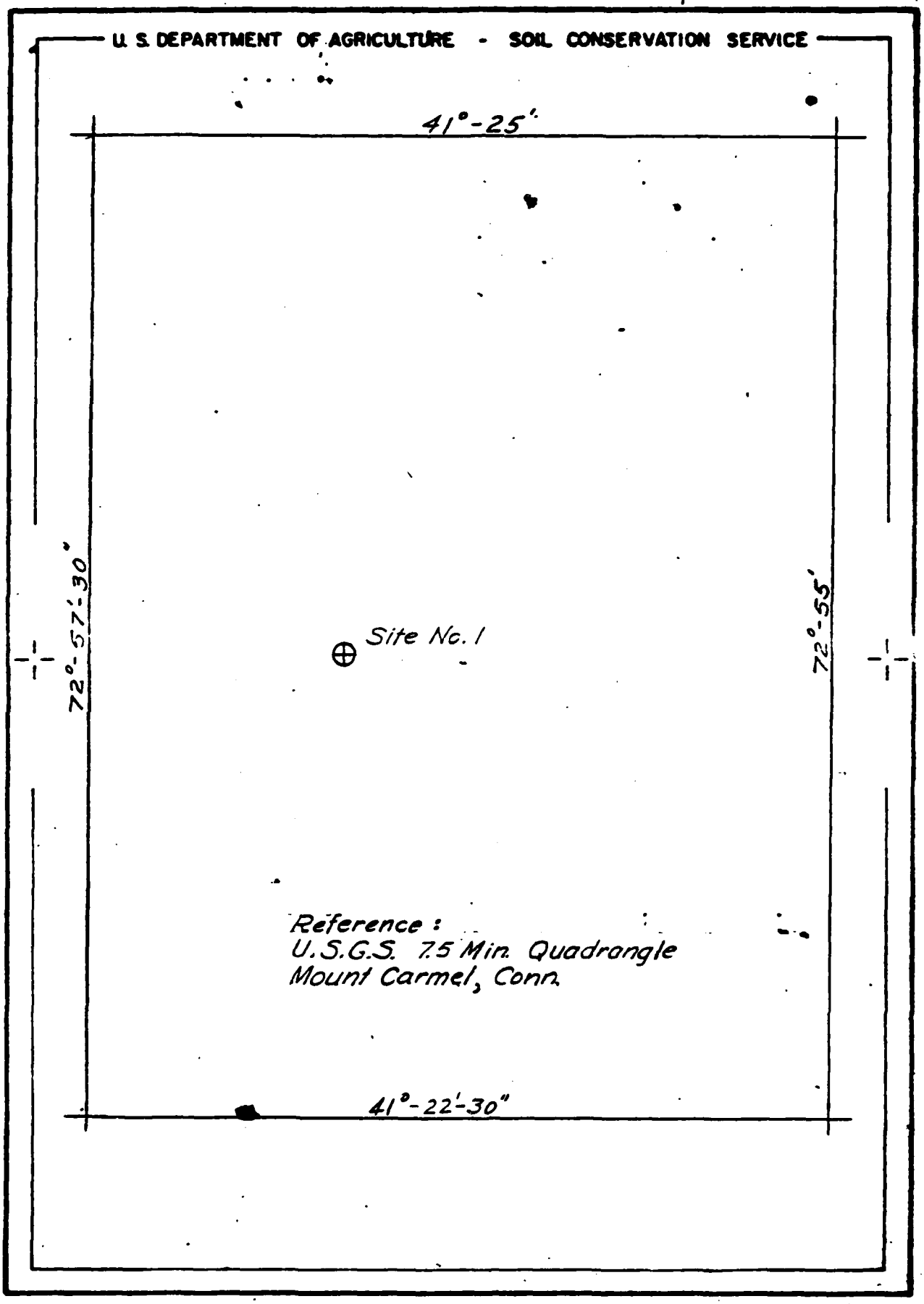
2/ Maximum elevation as determined by: (a) routing SCS freeboard hydrograph
(b) design high water elevation plus 2'

3/ Value obtained from SCS freeboard routing.

SHEET 3

CONNECTICUT STATE OFFICE, STORRS, CONN.

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE



OF - 2

Sheet 4

U.S DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Criteria and procedures used in this design are given in the following Soil Conservation Service publications:

National Engineering Memorandum No. 27 (3/19/65), Limiting Criteria for the Design of Earth Dams
National Engineering Memorandum No. 50 (5/16/63), Drop Inlet Spillway Standards
National Engineering Handbook Section 4, Hydrology
National Engineering Handbook Section 5, Hydraulics
National Engineering Handbook Section 6, Structural Design
National Engineering Handbook Section 8, Geology
Engineering Division Technical Release No. 2, Earth Spillways
Engineering Division Technical Release No. 5, Structural Design of Underground Conduits
Engineering Division Technical Release No. 12, Procedure for Computing Sediment Requirements for Retarding Reservoirs
Engineering Division Technical Release No. 29, Hydraulics of Two-Way Covered Risers
Engineering Division Technical Release No. 30, Structural Design of Standard Covered Risers
Engineering Division Technical Release No. 31, Structural Analysis and Design at Low Stage Inlets

Copies of the above publications may be obtained from Mr. State Conservationist, USDA, Soil Conservation Service, Mansfield Professional Park, Storrs, Connecticut 06268

State Conservation Engineer

COMPUTATION SHEET
SCS-523 REV 5-58

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE

PROJECT

BY DATE CHECKED BY DATE JOB NO

SUBJECT

SHEET OF

Item	Sheet No.
Curve Computations - Embankment [illegible]	[illegible]
Curve Computations - Embankment No. 1	1
[illegible]	5

COMPUTATION SHEET
SCS-523 REV 5-58

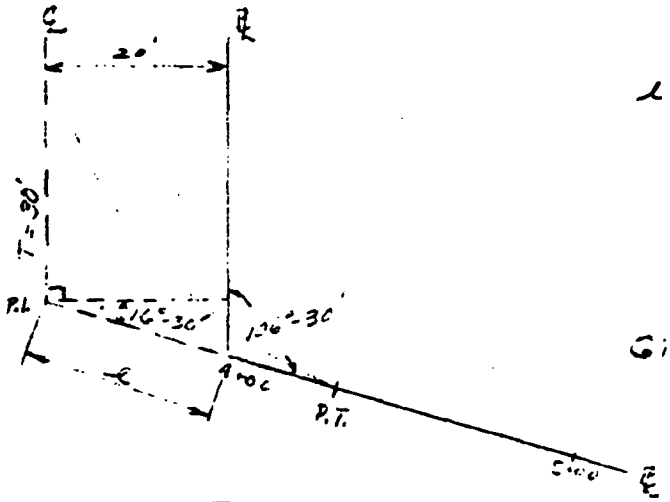
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn. PROJECT FARM Creek W.S. — Site 1

BY WTF DATE 2-7-68 CHECKED BY DATE JOB NO.

SUBJECT Curve Computations - Emb. & Ditch SHEET 1 OF 5

Emb.



$$l = \frac{20}{\cos 16\text{-}30} = \frac{20}{.9588197} = \underline{20.86}$$

Given:

$\Delta = 73°\text{-}30'$

$\frac{\Delta}{2} = 36°\text{-}45'$

$T = \underline{30.00'}$

$$R = \frac{T}{\tan \frac{\Delta}{2}} = \frac{30.00}{.7467354} = \underline{40.17'}$$

Sta. of P.T. = 4+00 + (30 - 20.86)

= 4+09.14

$$L = \frac{\Delta}{360} \times 2\pi R$$

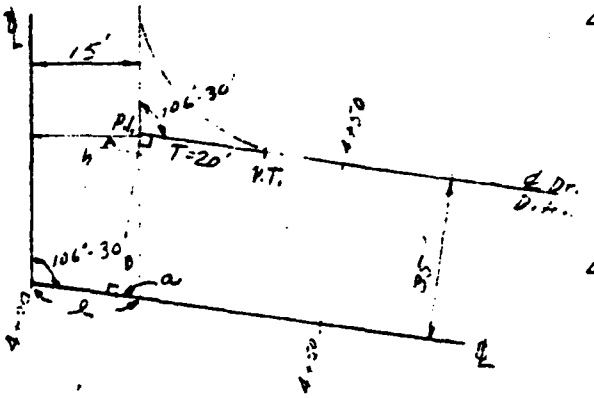
$$= \frac{73.5}{360} \times 6.2832 \times 40.17$$

$$= \underline{51.54'}$$

Sta. of P.C. = 4+09.14 - 51.54

= 3+57.60

Drain. Ditch



$T = 20.00'$

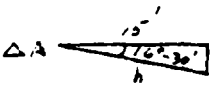
$\Delta = 73°\text{-}30'$

$\frac{\Delta}{2} = 36°\text{-}45'$

$$R = \frac{T}{\tan \frac{\Delta}{2}} = \frac{20.00}{.7467354} = \underline{26.78}$$

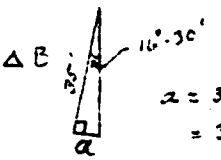
$$L = \frac{73.5}{360} \times 6.2832 \times 26.78$$

$$= \underline{34.35}$$



$$h = \frac{15}{\cos 16\text{-}30} = \frac{15}{.9588197} = 15.64'$$

$l = h = \underline{15.64'}$



$a = 35 \tan 16\text{-}30$

$= 35 (.2962135)$

$= \underline{10.37'}$

Sta. of P.I. = 4+00 + (15.64 - 10.37)

= 4+05.27

Sta. of P.T. = 4+05.27

- 34.35

Sta. of P.C. = 3+70.92

SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Co[illegible] PROJECT Farm Bl[illegible] - Site #1

BY [illegible] DATE [illegible] CHECKED BY [illegible] DATE [illegible] JOB NO [illegible]

SUBJECT Embankment [illegible] 2 — Curve Data [illegible] SHEET [illegible] OF 5

Embankment Curve

From Sheet 1 :

$\Delta = 73°-30'$

$\frac{\Delta}{2} = 36°-45'$

$T = 30.00'$

$R = 40.17'$

$L = 51.54'$

Compute L.C., M, E and defl ∠ for a 25' chord

1. $L.C. = 2T \cos\frac{\Delta}{2} = 60.00\,(.8012534) = \underline{48.08 = L.C.}$

2. $M = R \text{ vers } \frac{\Delta}{2} = 40.17\,(.1987462) = \underline{7.98 = M}$

3. $E = R \text{ ex sec. } \frac{\Delta}{2} = 40.17\,(.2480440) = \underline{9.96 = E}$

4. Defl ∠ for 25' chord: $c = 25'$, $R = 40.17'$

$$\sin\frac{\alpha}{2} = \frac{c/2}{R} = \frac{12.5}{40.17} = .3111774$$

$$\frac{\alpha}{2} = 18°-07'-49''$$

Say $18°-08'$

Station	Defl. ∠	Chord
P.C. 3+57.60		
3+83.02	18°-08'	25.00
P.T. 4+09.14	36°-45'	48.08

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE | PROJECT
BY | DATE | CHECKED BY | DATE | JOB NO.
SUBJECT
SHEET 3 OF 5

Drainage Ditch

From Sheet 1 : $\Delta = 73^\circ - 30'$,
$\frac{\Delta}{2} = 36^\circ - 45'$
$T = 20.00$
$R = 26.78$
$L = 34.35$

Compute :

$$A.C. = 2T \sin\frac{\Delta}{2} = 40.00 (.801538) = 32.05'$$

$$M = R \text{ vers } \frac{\Delta}{2} = 26.78 (.193864) = 5.32'$$

$$E = R \text{ ex sec } \frac{\Delta}{2} = 26.78 (.248440) = 6.64$$

Sta. P.C. = 3+90.92

Sta. P.T. = 4+25.27

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE [illegible] PROJECT FARM [illegible] SITE [illegible]
BY WTF DATE [illegible] CHECKED BY [illegible] DATE [illegible] JOB NO. [illegible]
SUBJECT EMBANKMENT No. 1 — CURVE DATA SHEET 4 OF 5

Both curves in outlet channel have same curve data:

$\Delta = 15°-00'$

$\frac{\Delta}{2} = 7°-30'$

$T = 20.00$

$R = 151.92$

$L = 39.77$

Compute L.C., M, E and deflection ∡ for a 20' chord

1. $L.C. = 2T \cos\frac{\Delta}{2} = 40.00\,(.9914449) = 39.66'$

2. $M = R \text{ vers } \frac{\Delta}{2} = 151.92\,(.0085551) = 1.30'$

3. $E = R \text{ ex sec } \frac{\Delta}{2} = 151.92\,(.0086290) = 1.31'$

4. Defl ∡ for 20' chord:

$$\sin\frac{\alpha}{2} = \frac{\alpha/2}{R} = \frac{10}{151.92} = .0658241$$

$$\frac{\alpha}{2} = 3°-46'-27''$$

say $3°-46'$

	Station	Defl. Angle	Chord
Curve 1:	P.C. 2+80		
	3+00.02	3°-46' L	20.00'
	P.T. 3+19.77	7°-30' L	39.66'
Curve 2:	P.C. 3+79.77		
	3+99.79	3°-46' R	20.00'
	P.T. 4+19.54	7°-30' R	39.66'

COMPUTATION SHEET
SCS 523 REV 5-58

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE [illegible] PROJECT [illegible] Brook Site
BY [illegible] DATE [illegible] CHECKED BY [illegible] DATE [illegible] JOB NO. [illegible]
SUBJECT [illegible] Spill Inverts SHEET 5 OF 5

Conduit

Joint No.	Dist. from Riser Wall-ft	Inv. Elev. 30" RCP	Slope
J-1	.04	277.0	S = 1.25%
J-2	16.04	276.80	
J-3	32.04	276.60	
J-4	48.04	276.40	
J-5	64.04	276.20	
Outlet	80.04	276.00	

Above dimensions for lengths of pipe are based on nominal lengths and do not include creep.

Anti-Seep Collars

Collar No.	Dist. from Riser Wall-ft.	Invert Elev. of 30" RCP
~~I~~	~~[illegible]~~	~~[illegible]~~
~~II~~	~~[illegible]~~	~~[illegible]~~
I	18.0	276.77
II	36.0	276.55
III	54.0	276.32

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—479667

STATE Conn		PROJECT Farm Brook Site 1		
BY WHL	DATE 3-24-72	CHECKED BY	DATE	JOB NO. CN-428
SUBJECT Hydraulics Index				SHEET ___ OF ___

Item	Sheet
Stage-Storage Data	1
Area-Capacity Curves	2
Soil Cover Complex No.	3
Time of Concentration	4
Sediment Design Summary	5
Principal Spillway Hydraulics	6
Profile - Farm Brook below dam	7
Backwater Computations	8-36
Stage-Discharge Comps.	37
Principal Spillway Routing	38-40
Emergency Spillway Hydraulics	41
Emer. Spwy. Design Routing	42-44
SCS Freeboard Routing	45-47
Emergency Spillway Hydraulics	48
Riser Modification	49-50
Drainage Ditch Outlet	51
Diversion Ditch No.1	52,53
Borrow Area Drainage	54

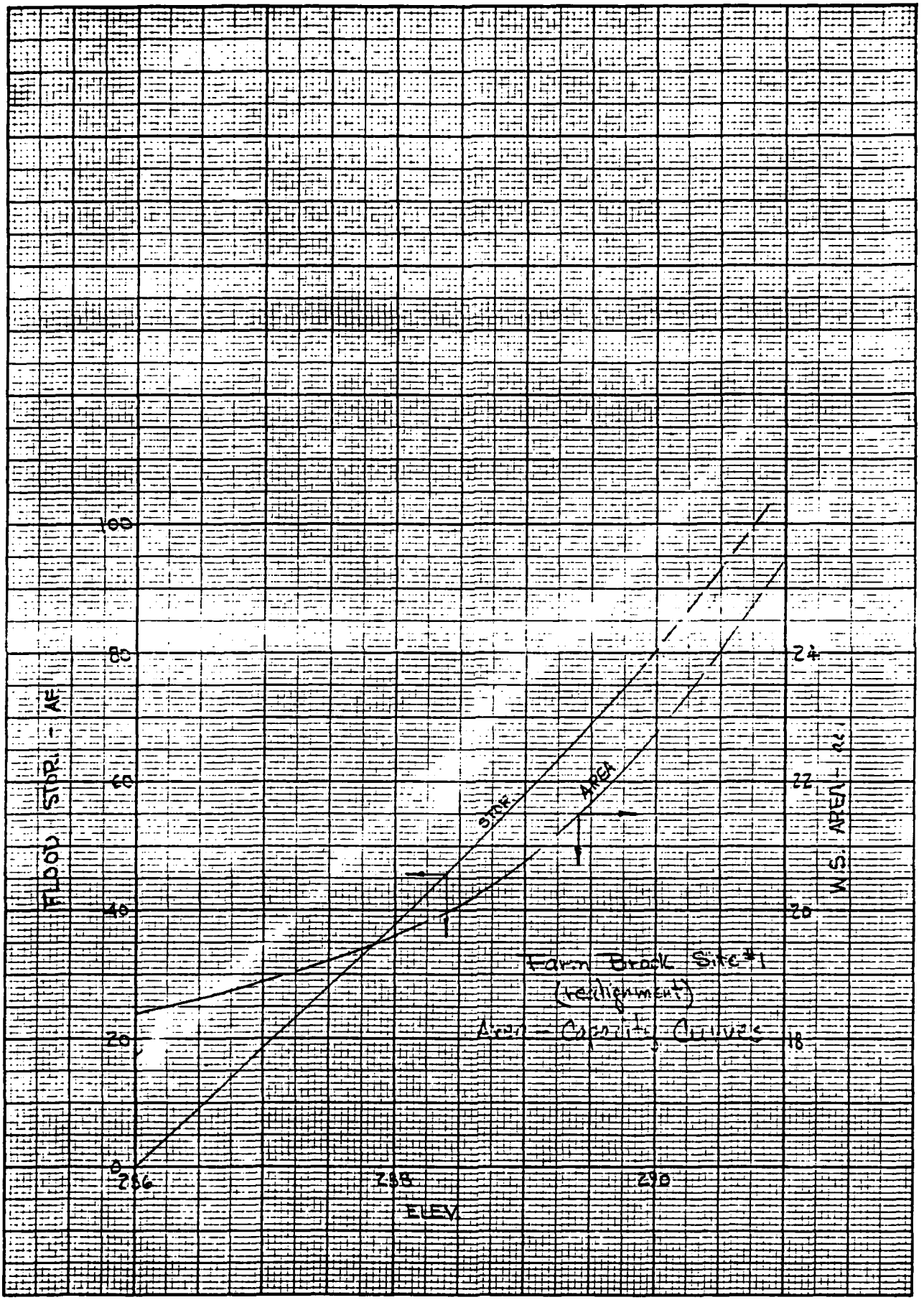
COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
Conn		Farm Brook Site 1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WHL	10-21-71			CN-428
SUBJECT				SHEET 1 OF
Revised Stage-Storage Data				

sediment stor. = 5 AF

Elev.	Area	Stor. Incr.	Total Accum. Stor	Rec. Stor	Flood Stor.
278	0.08 Ac		0 AF	5AF sedim.	
		1.69 AF			
280	1.61		1.7		
		13.81			
282	12.2		15.5	10.5	
		28.0			
284	15.8		43.5	38.5	
		34.2			
perm. pool — 286	18.4		77.7	72.7	0
		38.0			
288	19.6		115.7		38
		42.4			
290	22.8		158.1		80.4


Farm Brook Site #1
(realignment)
Area - Capacity Curves
FLOOD STORE - AF
W.S. ELEV - FT
100
80
60
40
20
0
24
22
20
18
286
288
290
ELEV
STOR
APEA

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
CONN		FARM BROOK W.S. - SITE 1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WTF	8-22-67			CN-12E-H
SUBJECT				SHEET 3 OF
SOIL COVER COMPLEX No. (FUTURE' COND.)				

Drainage Area — .47 Sq. Mi. (300 Ac.)

Ref.: NEH - Sect 4 - Hydrology

Soil Group	Complex (Land Use)	Curve No.	Acres A	Cl. x A
B	Cropland	75	20	1500
B	Forest	57	100	5700
D	"	78	25	1950
B	Idle	61	10	610
B	Other	62	105	6510
C	"	69	5	345
D	"	91	35	3185
			300	21990

Weighted Curve No. II = $\frac{21990}{300}$ = 73.3 - use 73

Weighted Curve No. III = 87

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO . 1958 O—470867

STATE Conn		PROJECT Farm Brook #1		
BY WTF	DATE 5-67	CHECKED BY WHL	DATE 6-19-68	JOB NO. CN-428-H
SUBJECT Time of Concentration - T_c				SHEET 4 OF

Channel Hydraulics for T_c

$$v = \frac{1.486}{n} \cdot r^{2/3} \cdot s^{1/2}$$

Reach No.	Section	Area Sq. Ft.	P Ft.	r	S ft/ft	n	V fps
0-3	1	(From W.S.-HYDROL. [illegible])			.126		1.7
3-4	2	2	4	0.5	.022	.045	3.1
4-5	3	5	8	0.6	.054	.065	3.8
5-6	4	8	10	0.8	.025	.050	4.0
6-7	5	10	10	1.0	.006	.050	2.3

Time of Concentration - T_c

Description of Watercourse	Length of Course ft	Velocity fps	Time sec
Overland Flow: Woodland S=.126	1400	1.7	820
Channel: Section 2	1100	3.1	355
3	740	3.8	195
4	800	4.0	200
5	900	2.3	390
			1960

$$T_c = \frac{1960 \text{ sec}}{3600 \text{ sec/hr}} = .54 \text{ hrs., use } \underline{\underline{.5}} \text{ hrs}$$

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-309
8-58

RESERVOIR SEDIMENTATION DESIGN SUMMARY

WATERSHED Farm Brook SITE NO. 1 STATE Connecticut

LOCATION Hamden DATE May 1963

DATA COMPUTED BY William M. Brown TITLE Geologist

SEDIMENT SOURCES (AVERAGE ANNUAL)

TYPE OF EROSION		PRESENT CONDITIONS			FUTURE (AFTER CONS. TREATMENT)			
		ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)	ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)	AREA OF WATERSHED
SHEET EROSION	CULTIVATED LAND	35	16	560	20	16	320	300 ACRES
								0.47 SQ. MI.
	IDLE LAND	25	0.10	3	10	0.10	1.0	
	PASTURE-RANGE							
	WOODLAND	200	0.10	20	125	0.10	13	
	OTHER (Housing)	25 Tot. 22	2.1	46	66		81 69	
TOTAL SHEET EROSION			DELIVERY RATE (%) 30	629	TONS DELIVERED 189	DELIVERY RATE (%) 30	484	TONS DELIVERED 145
CHANNEL EROSION	GULLY							
	STREAMBANK		35	34	12	35	34	12
	STREAMBED							
FLOODPLAIN SCOUR								
OTHER (ROADSIDE ETC.)			30	37	11	30	128	38
TOTALS				700	212		646	195

DEPOSITION

AVERAGE DRY WEIGHT OF UPLAND SOILS: 85 LBS/CU. FT.		
TEXTURE OF SEDIMENT		
% CLAY	% SILT	% COARSE
3	15	61 Sand 21 Gvl

AVERAGE ANNUAL SEDIMENT DELIVERED TO SITE FROM ALL SOURCES (TONS)		TRAP EFFICIENCY (%)	ANNUAL DEPOSITION (TONS)	DESIGN PERIOD (YRS)	PERIOD TOTAL DEPOSITION (TONS)
PRESENT	212	95	201	15	3015
FUTURE	195	95	185	35	6475
			DESIGN TOTALS	50	9490

SEDIMENT STORAGE REQUIREMENTS

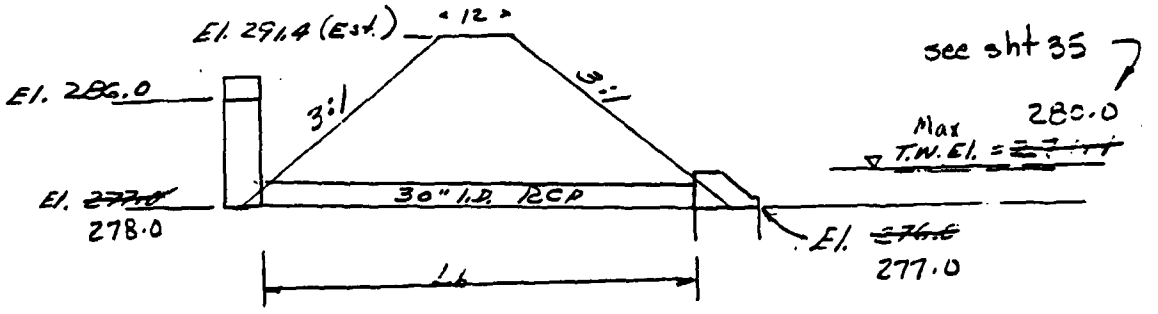
CONDITION OF SEDIMENT	% OF TOTAL	DEPOSITION (TONS)	VOLUME WEIGHT OF SEDIMENT		STORAGE REQUIRED		STORAGE ALLOCATION (ACRE FEET)		
			LBS/CU. FT.	TONS/AC. FT.	ACRE-FEET	WATERSHED INCHES	SEDIMENT POOL	RETARDING POOL	OTHER
SUBMERGED	80	7592	80	1740	4.4	0.18	4.4		-
AERATED	20	1898	95	2070	0.9	0.04	-	0.9	-
TOTALS		9490			5.3	0.22	4.4	0.9	-

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn		PROJECT FB #1		
BY WTF	DATE 5-26-67	CHECKED BY WHL	DATE 6-17-68	JOB NO. CN-428-H
SUBJECT PRINCIPAL SPILLWAY HYDRAULICS				SHEET 6 OF

Reference: T.R 29



see sht 35

Max T.W. El. = 280.0

Height of Dam = 15'±
Base width = 15 × 6 + 12 = 102'

Approx. L_b = 102 less part of length of Riser & Impact Basin, say 12'

$\therefore L_b = 90'$ (Prelim.)

$D = 2.5'$
$L = 3D = 7.5'$
$L_o = 2D = 5.0'$
$N_{ib} = 9'$
$K_e = 1.0'$
$K_p = .0078'$
$L_b = 90'$
$a_b = 4.91'$

$C_b = \frac{1}{\sqrt{2 + .0078 \cdot 90}} = .608$, say .61'

Weir Flow, $Q_{hc} = C_w (2L) H_h^{3/2}$ where $C_w = 3.1'$

$Q_{hc} = 46.5' H_h^{3/2}$

Pipe Flow, $Q_{hc} = C_b a_b \sqrt{2gH_o}$

$= .61(4.91)(8.02)\sqrt{H_o}$

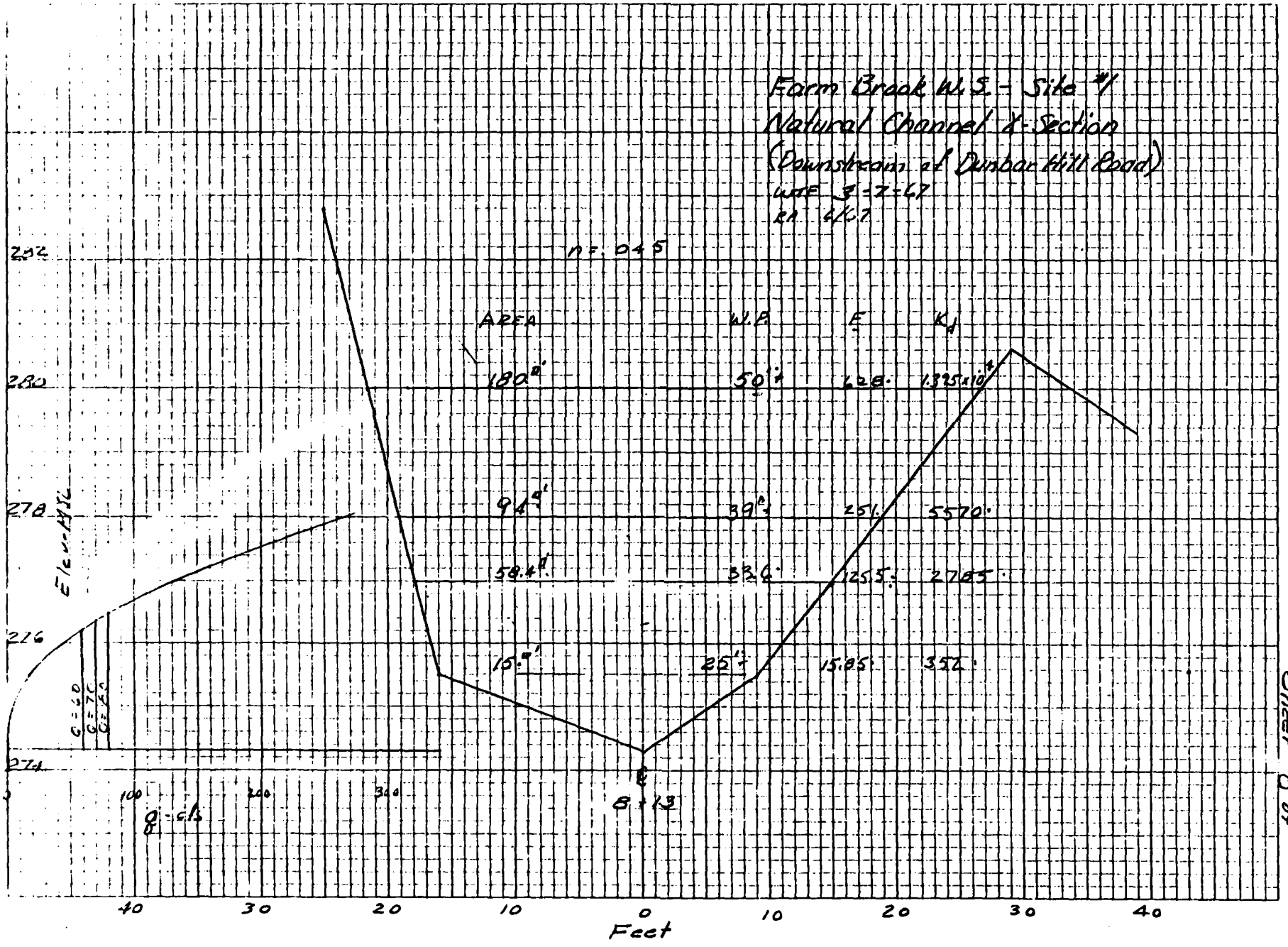
$= 24\sqrt{H_o}'$

H_o = ~~W.S. Elev. – R.S. Outlet (E) Elev.~~

= ~~W.S. – 277.25~~

or W. S. Elev. – T.W. Elev. (280.0)

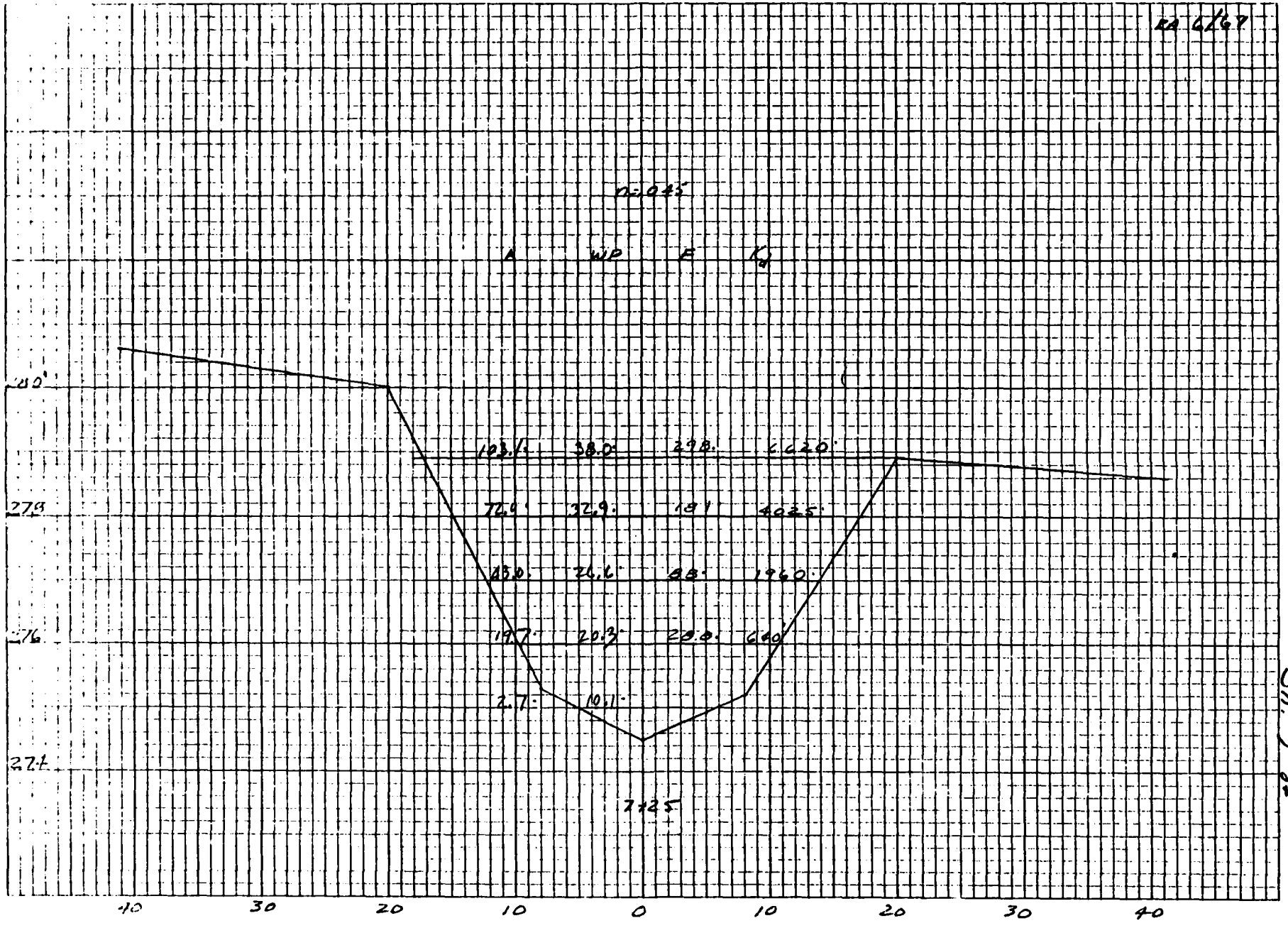
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.



Sheet 8 of

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Sh. 9 of

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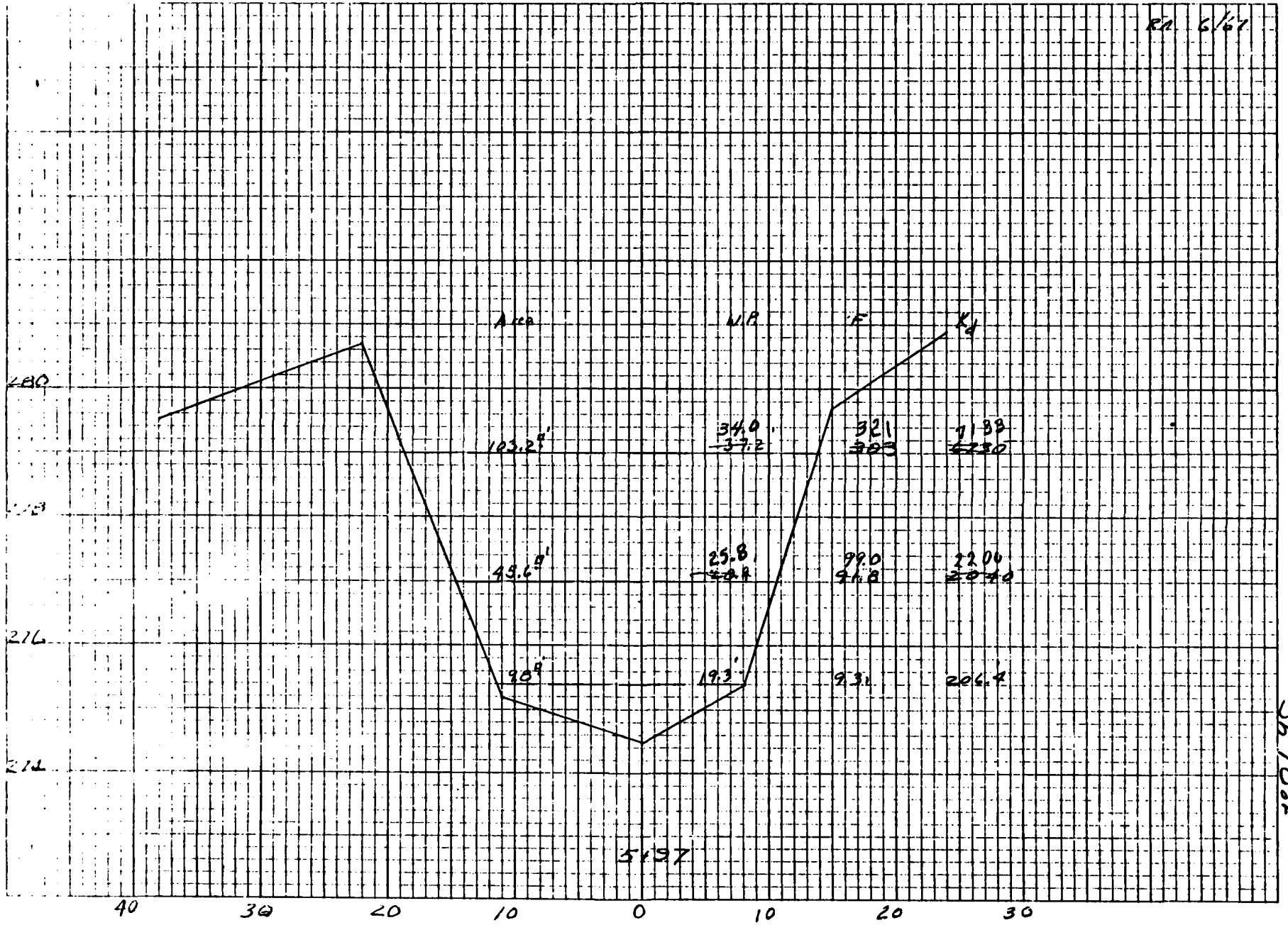

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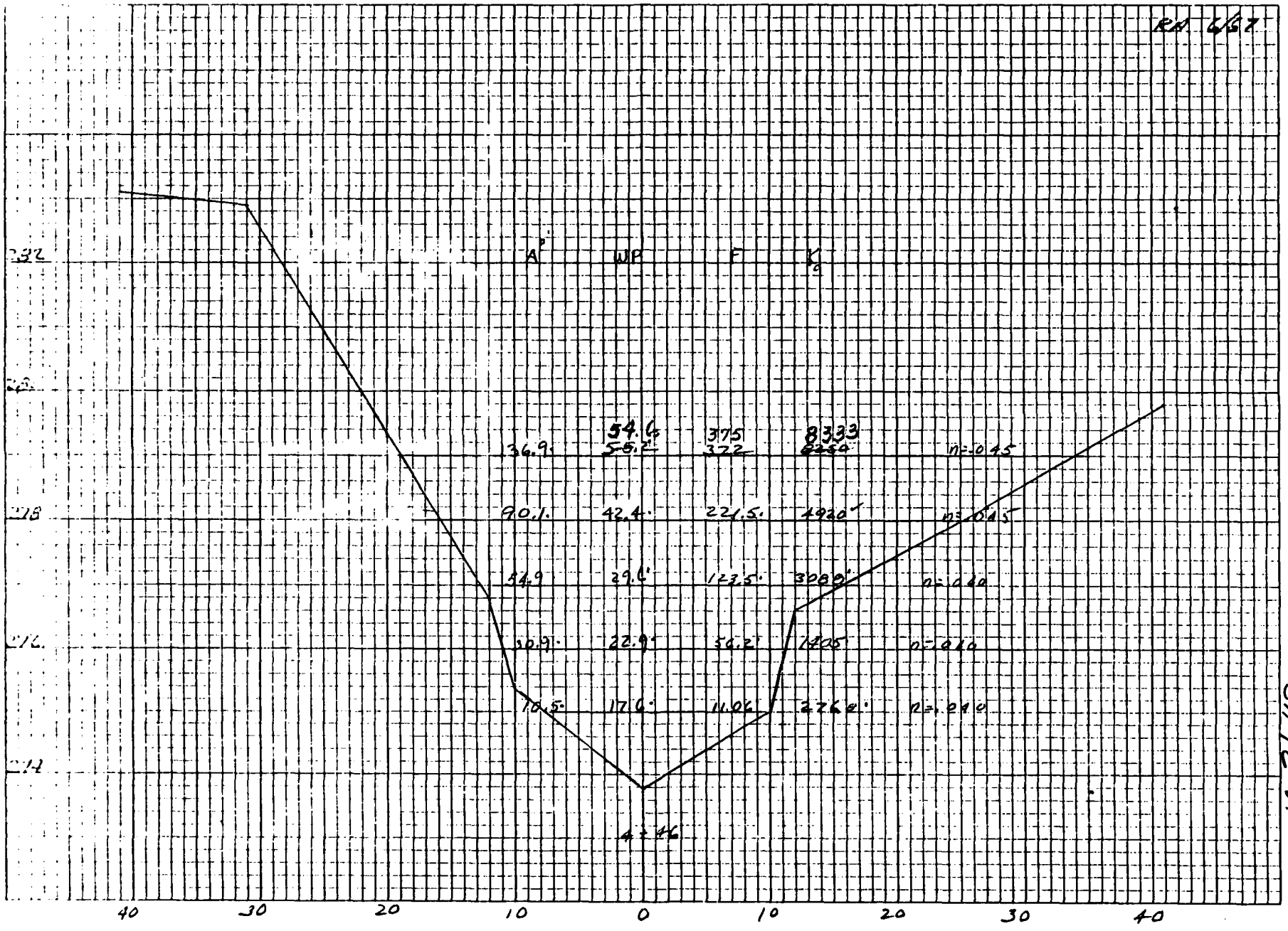

Sh 12 .1

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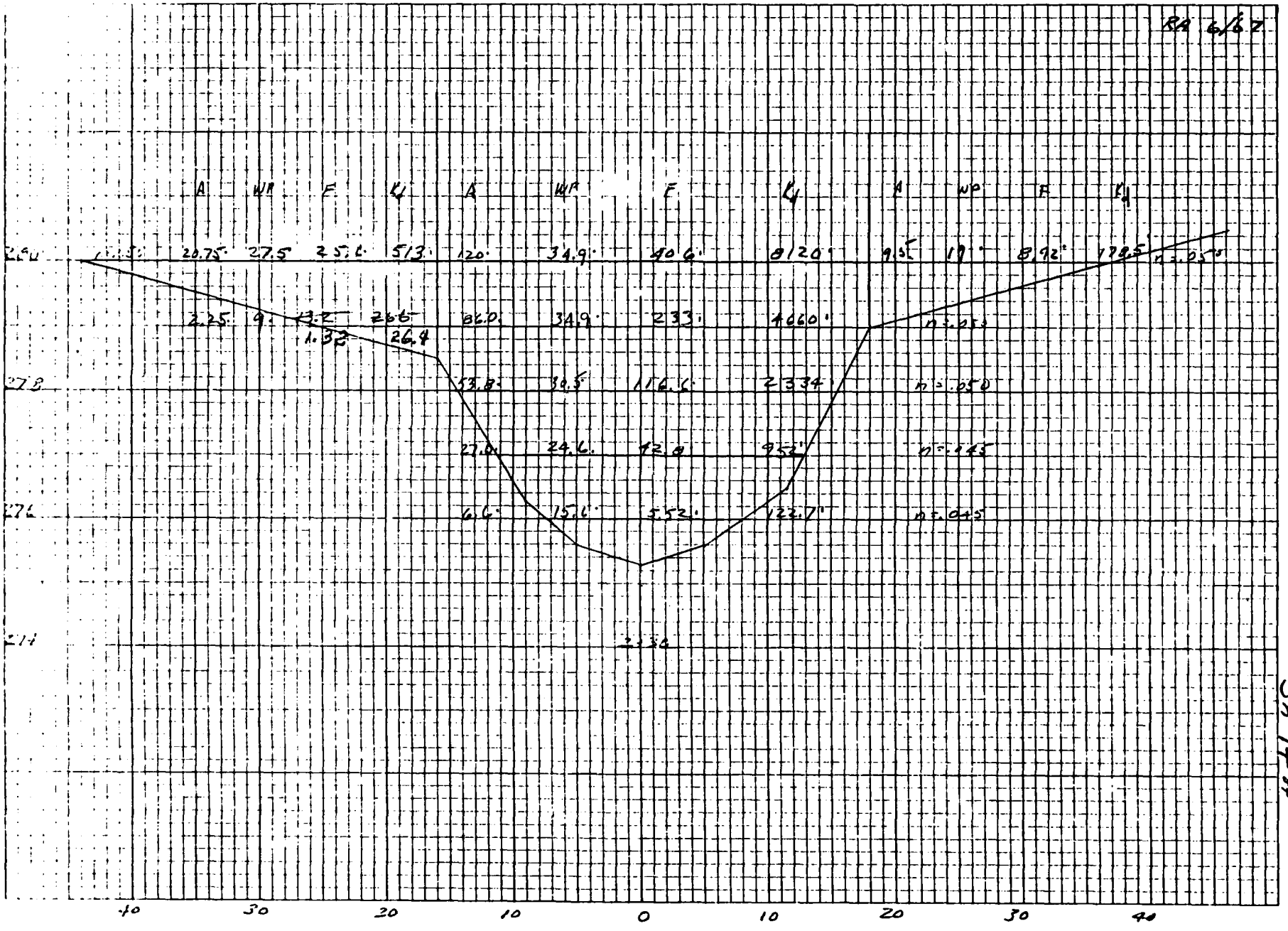
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Sh 14 of

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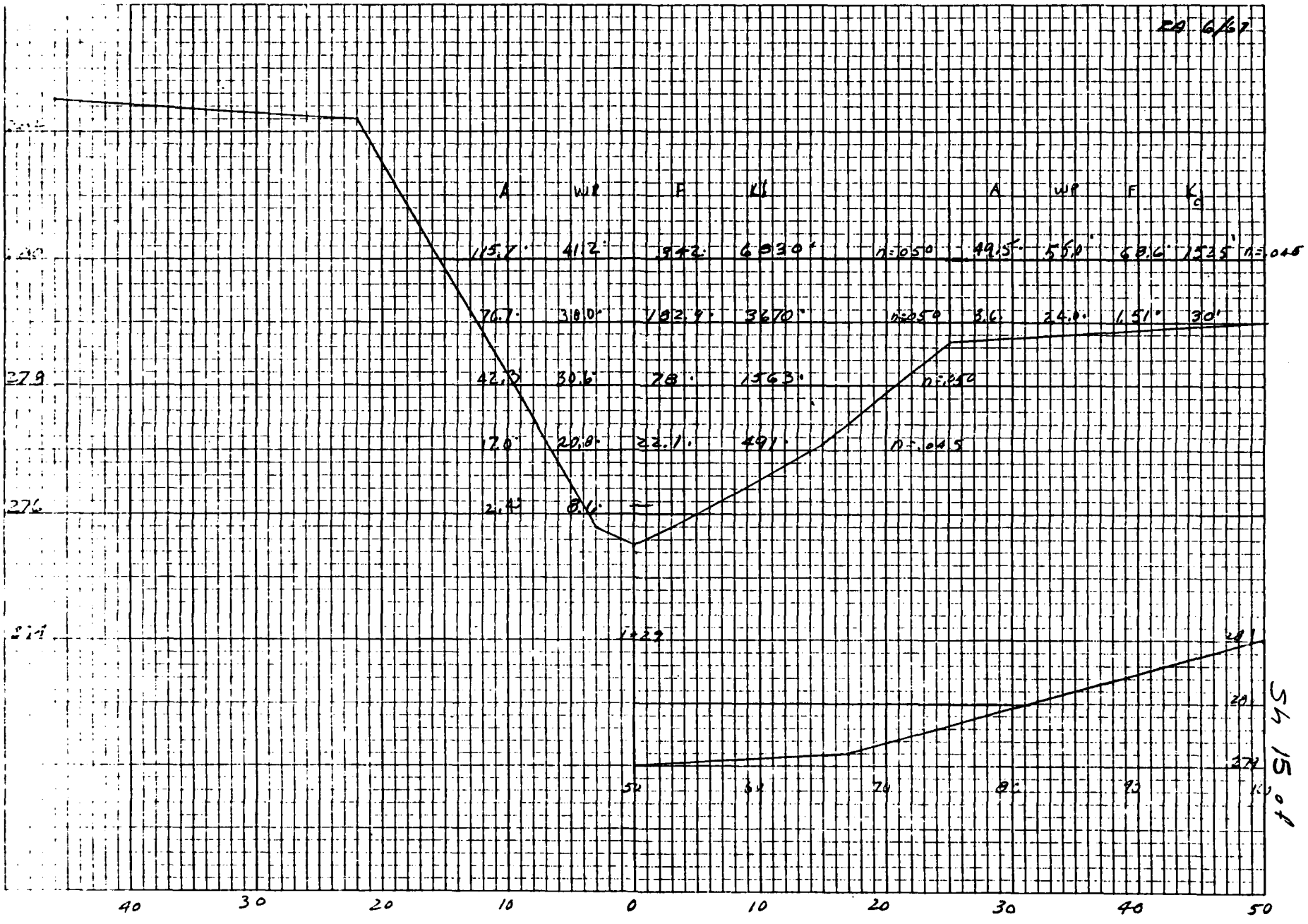

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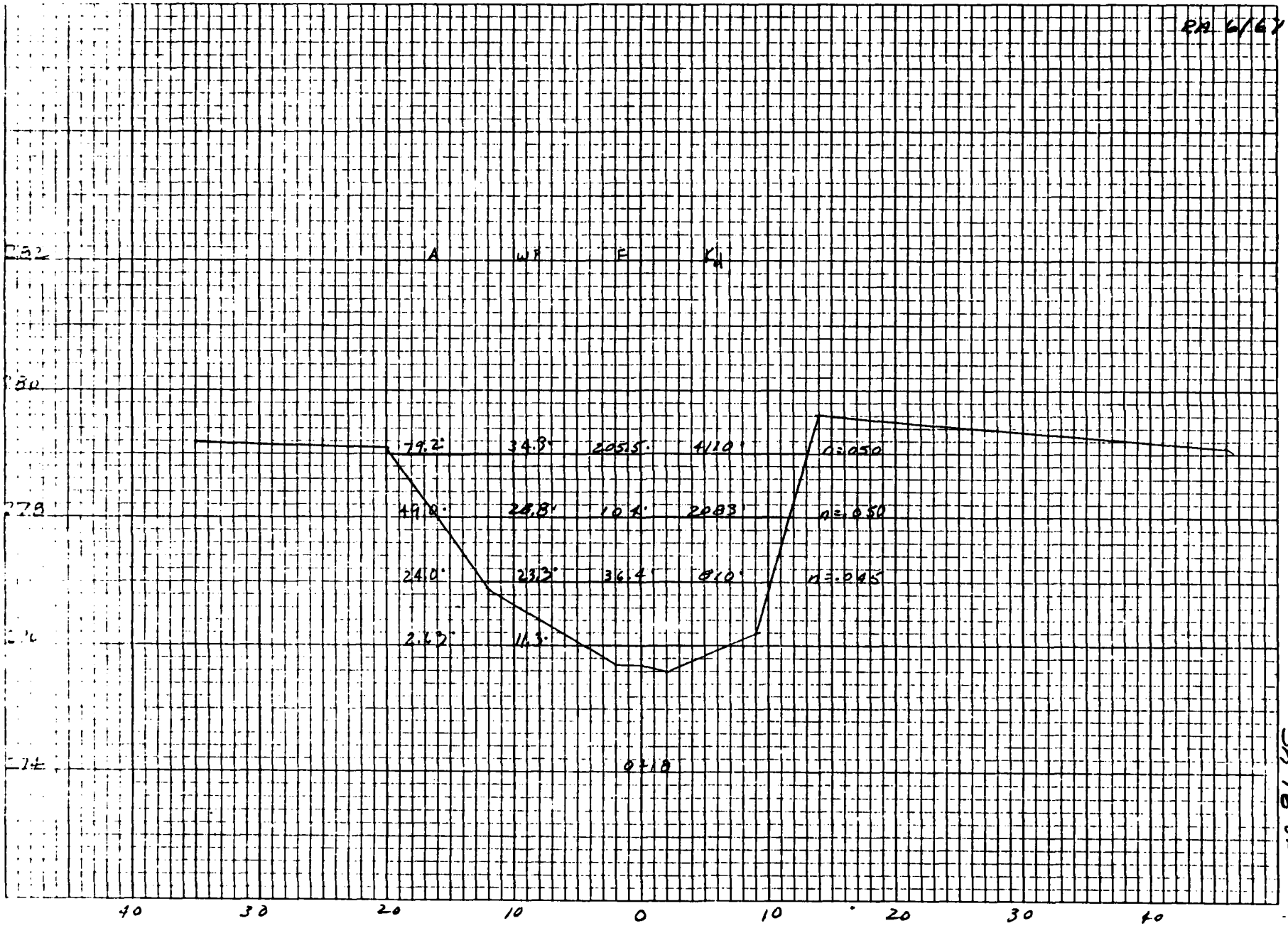
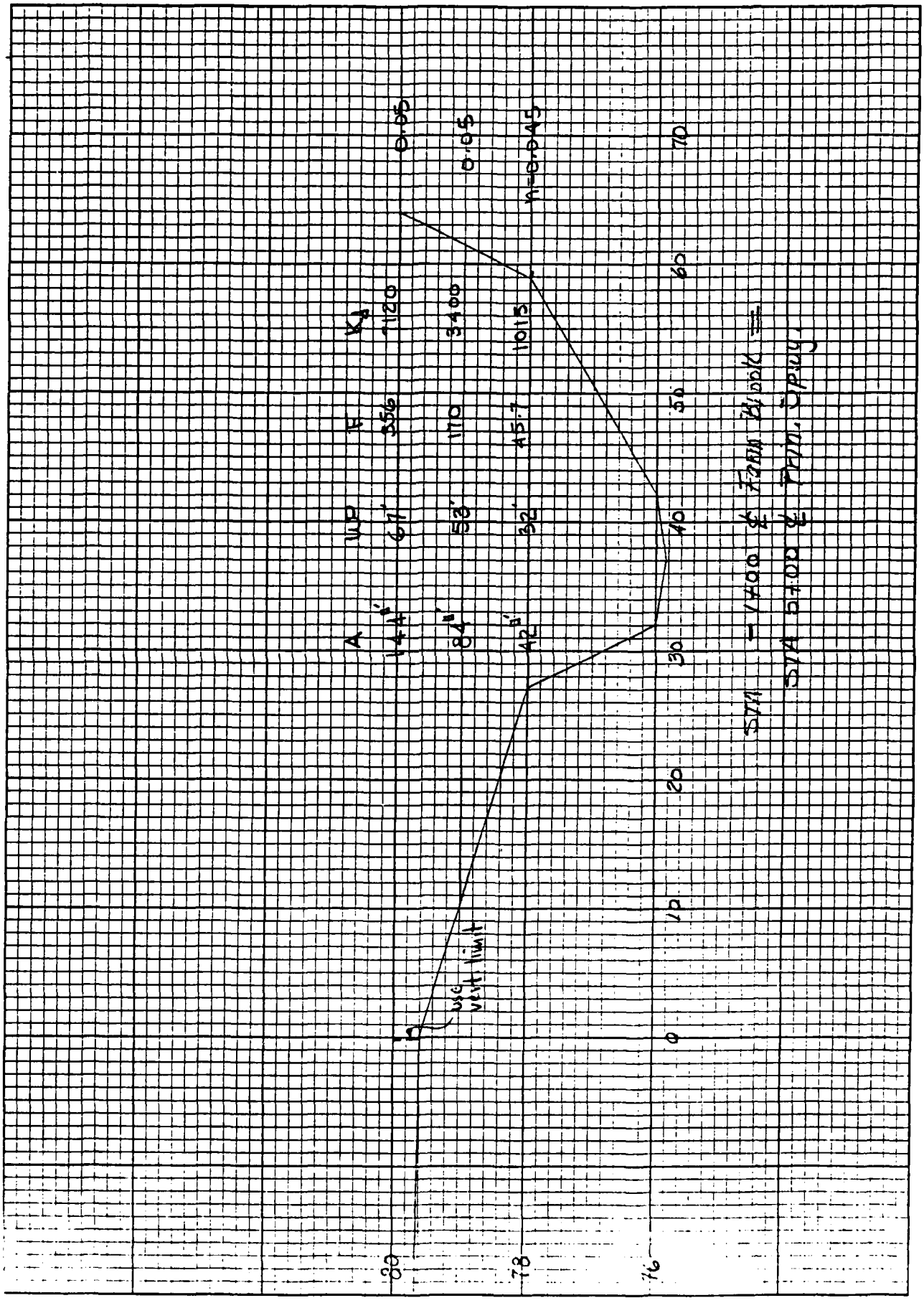
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

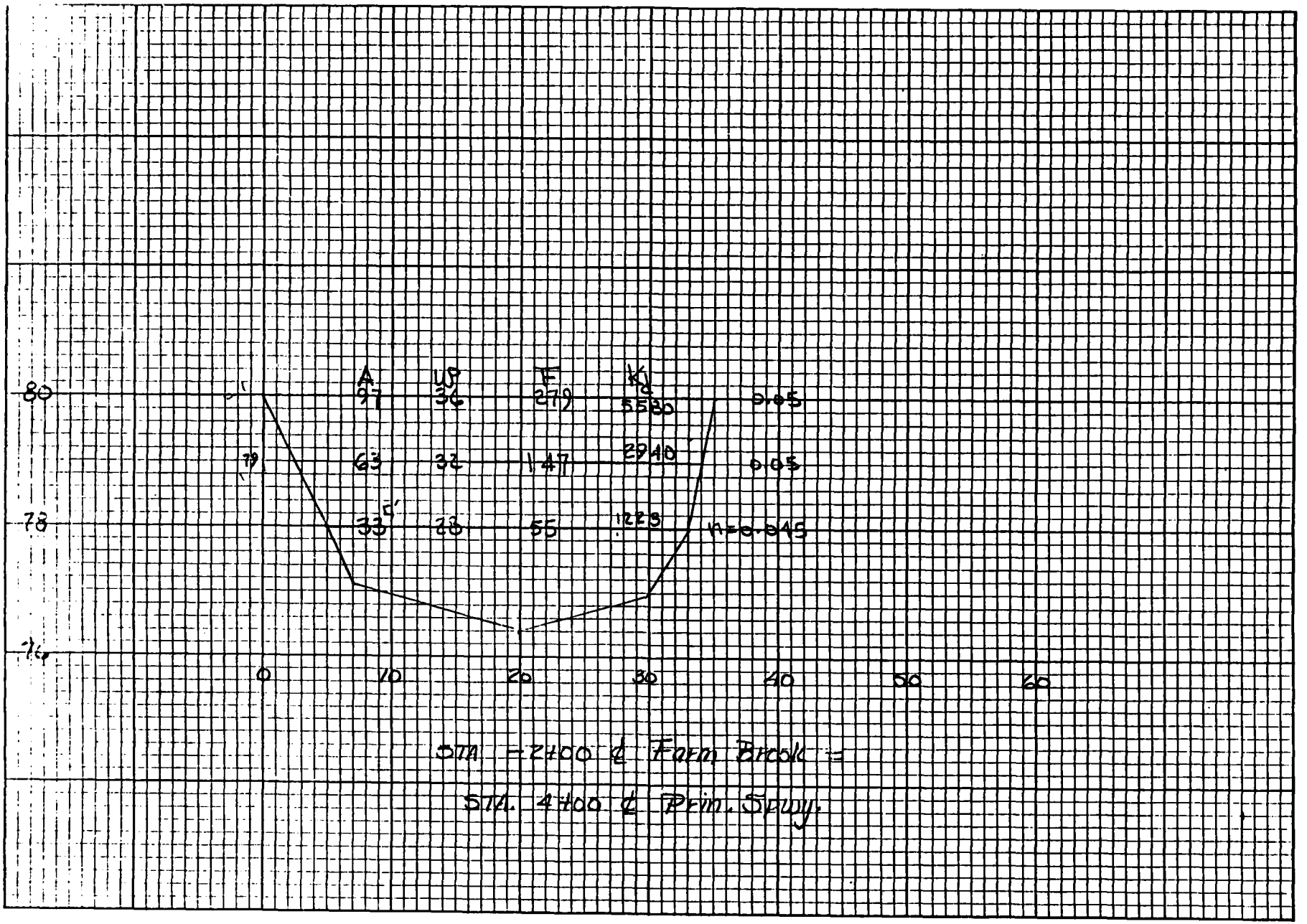


Sh 16 of

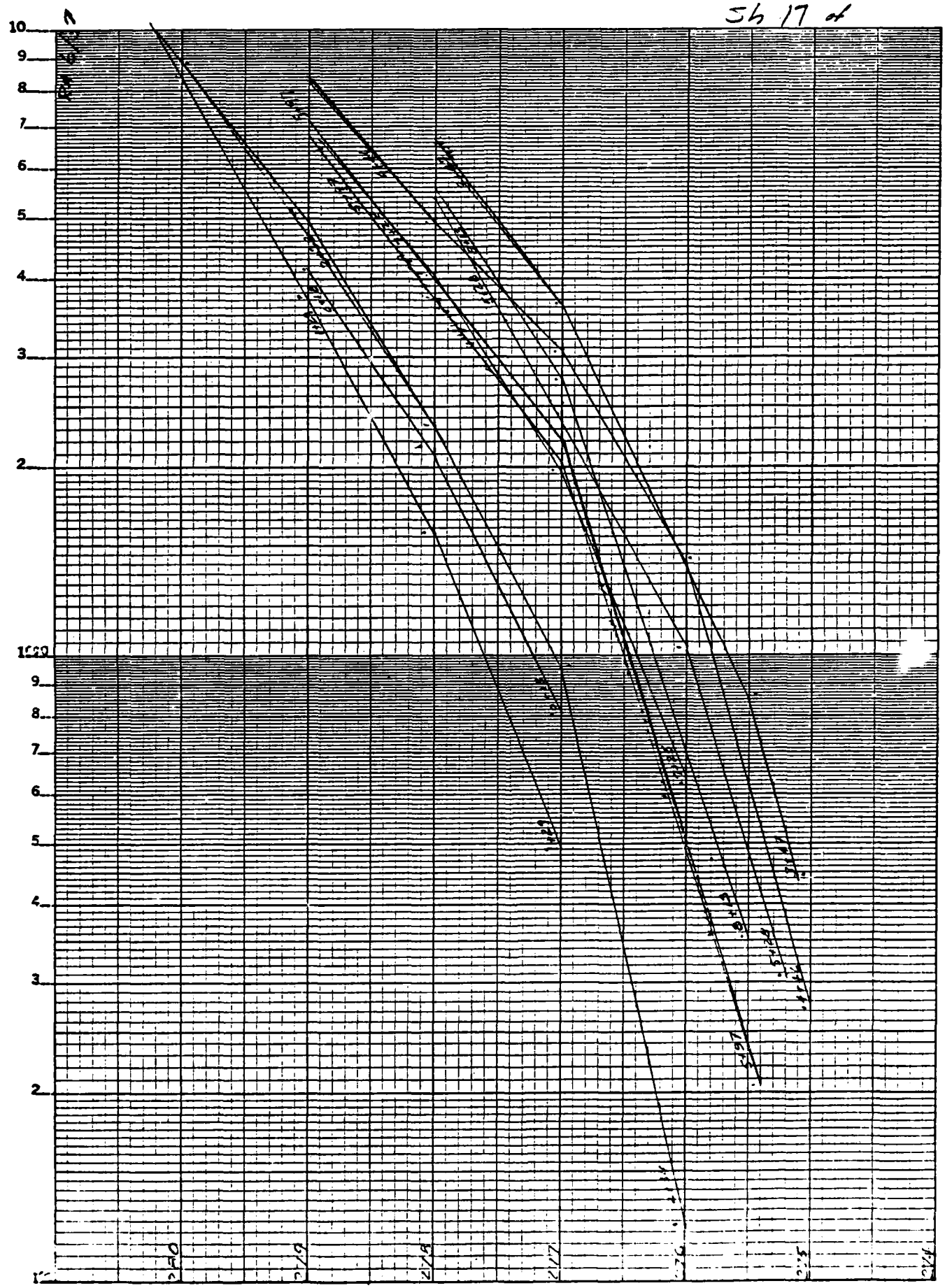


KOE 10 X 10 TO THE INCH 46 0702
7 X 10 INCHES
KEUFFEL & ESSER CO

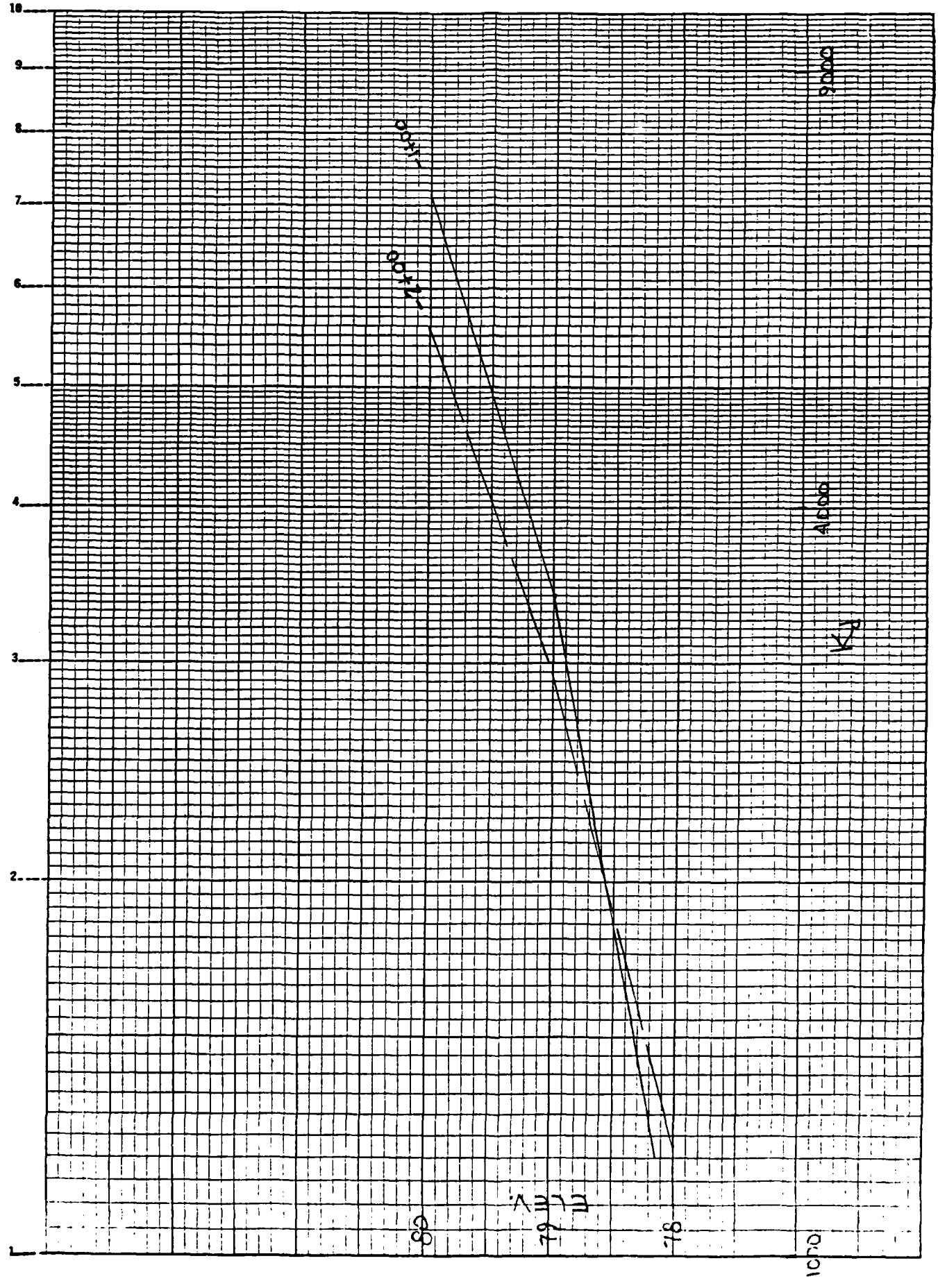
K+E 10 X 10 TO THE INCH 46 0702
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO



sh. 16B



KEUFFEL & ESSER CO. 359-61G
SEMI-LOGARITHMIC
2 CYCLES X 70 DIVISIONS
MADE IN U.S.A.



K&E SEMI-LOGARITHMIC 359-51G
KEUFFEL & ESSER CO. MADE IN U.S.A.
1 CYCLE X 70 DIVISIONS

SCS-344 5-57
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

I.H. 6/67

Sh. 18 of

FARM BROOK W.S. - SITE #1

W.S. Profile for Tailwater on Principal Spillway

Q = 60 cfs

SECTION	L ft	Elev E_1	K_d	$S^{1/2}$	S	H_1	Elev E_2	
8+13		276.20'	915'					
7+25	88	276.31	900'	.0667'	.00445'	.392'	276.59'	
		276.40	1000'	.060'	.0036'	.317'	276.52'	
		276.49	1100'	.0546'	.00298'	.262'	276.46'	
		276.47	1080'	.0556'	.00308'	.271'	276.47'	ok
5+97	128'	276.50	1050 ~~[illegible]~~	.0571 ~~.060~~	.0033 ~~.0036~~	.42[illegible] .461	89 276.~~93~~	
		276.7[illegible]	[illegible]	[illegible]	[illegible]	.174 .205	[illegible]4 276.68	
		276.74	1510 ~~1400~~	.0397 ~~.0420~~	.00158 ~~[illegible]~~	.202 ~~[illegible]~~	67 276.~~70~~	
		276.72	1475 ~~1350~~	.0407 ~~.0444~~	.0016[illegible] .00197	.212 .252	68 276.~~72~~	ok
		276.70	1425	.0421	.00177	.227	276.70	ok
See Shts ~~2-4~~ 17-19 for Comps thru twin 48" RCP to Sta 5+57								
5+57		277.01 ✓						
5+28	29'	277.10	2560'	.0234'	.00055'	.016'	277.03'	
		277.06	2480'	.0242'	.000584'	.017'	277.03'	
		277.04	2430'	.0247'	.00061'	.018'	277.03'	
		277.03	2420'	.0248'	.000614'	.018'	277.03'	ok
4+46	82'	277.10	3200'	.01875'	.000352'	.029'	277.06'	
		277.06	3150'	.0191'	.000363'	.03'	277.06'	ok
3+47	99'	277.10	3850'	.0156'	.000242'	.024'	277.08'	
		277.08	3800'	.0158'	.00025'	.025'	277.08'	ok
See Shts 20 ~~5~~-21 for Comps thru Dunbar Hill Rd								

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SOIL CONSERVATION SERVICE

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Sh 19 of

FARM BROOK W.S - SITE #1

W.S. Profile for Tailwater on P.S. (Cont'd)

Q=60 cfs

SECTION	L ft	Elev E_1	K_d	$S^{1/2}$	S	H_1	Elev E_2	
2+69		278.44'						
2+38	31'	278.46	3200 ~~3270~~	.01075 ~~.01033~~	351 .000~~355~~	.01	278.45'	~~OK~~
		278.45	3190	.01881	.000353	.011	278.45	OK
1+29	109'	278.50	2400'	.0250'	.000625'	.068'	278.52'	
		278.52	2440'	.0246'	.000603'	.066	278.52'	OK'
0+18	111'	278.60'	3130'	.0192'	.000368'	.041'	278.56'	
		279.57	3080'	.0195'	.000379'	.042'	278.56'	OK
		278.56						

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

KA 6/67

Sh 20 of

FARM BROOK - SITE #1

W.S Profile for T.W on Princ. Spwy

Q = 70 cfs

SECTION	L H	Elev E_1	K_d	$S^{1/2}$	S	H_1	Elev E_2	
8+13'		276.35'						
7+25	88'	276.56'	1200'	.0583'	.00339'	.298'	276.65'	
		276.60'	1250'	.056'	.00313'	.275'	276.63'	
		276.62'	1280'	.0546'	.00298'	.262'	276.61'	OK
5+97	128'	276.65	12~~25~~ 75	.05~~71~~ 49	.003~~26~~ 01	.336 ~~.417~~	277.01 ~~277.04~~	
		276.90	1920 ~~1750~~	.0~~40~~ 36	.001~~8~~3	.170 ~~.205~~	276.~~83~~ 79	
		276.85	1800 ~~1640~~	.0~~427~~ [illegible]	.001~~62~~ 51	.194 ~~.233~~	276.81 ~~276.85~~	OK
		276.82	1730	.0405	.0016	.210	296.83	OK
See Sh		for	Comps. thru		48" RCP			
5+57		277.20 ~~277.46~~						
5+28	29'	277.22 ~~277.46~~	2830 ~~3920~~	.02473 ~~.02045~~	.000611 ~~.000415~~	.018 ~~.012~~	277.22 ~~277.46~~	OK ~~OK~~
4+46	82'	277.25 ~~277.47~~	3430 ~~3820~~	.02041 ~~.0183~~	.000416 ~~.000335~~	.034 ~~.0275~~	277.25 ~~277.49~~	OK
		~~277.49~~	~~3840~~	~~.0182~~	~~.000332~~	~~.027~~	~~277.49~~	OK
3+47	99'	277.27 ~~277.50~~	4230 ~~4920~~	.01655 ~~.0142~~	.000273 ~~.000202~~	.027 ~~.02~~	277.28 ~~277.51~~	OK
		277.~~51~~ 28						
See Sh 24		for Comps. thru Dunbar Hill Rd Culverts						
2+69		279.~~36~~ 13						
2+38	31'	279.15 ~~279.40~~	5150 ~~6210~~	.01359 ~~.0113~~	.000184 ~~.000126~~	.0057 ~~.0034~~	279.136 ~~279.364~~	
		279.14 ~~279.36~~	5130 ~~6080~~	.01365 ~~.0115~~	.000186 ~~.000132~~	.0058 ~~.0041~~	279.14 ~~279.364~~	OK

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Rh 6/67

Sh. 21 of

FARM BROOK - SITE #1

W.S. Profile for Tailwater on Princ. Spwy

Q = 70 cfs

SECTION	L	Elev E_1	K_d	$S^{1/2}$	S	H_1	Elev E_2	
2+38		279.~~36~~ 14						
1+29	109'	279.15 ~~279.37~~	4190 ~~5000~~	.01671 ~~.014~~	.000279 ~~.000196~~	.0304 ~~.0214~~	279.17 ~~279.39~~	~~OK~~
		279.17 ~~279.38~~	4250	.01647	.000271	.0295	279.17	OK
		Q = 80 cfs						
8+13'		276.5'						
7+25	88'	276.70	1400'	.0571'	.00325	.286'	276.79'	
		276.73	1440'	.0556'	.00308'	.271'	276.77'	
		276.75	1475'	.0542'	.00294'	.259'	276.76'	OK
		276.76'						
5+97	128'	276.78	1380 ~~1480~~	.0590 ~~.0541~~	.00336 ~~.00292~~	.430 .374	277.19	
		276.85	1775 ~~1630~~	.0451 ~~.0491~~	.00203 ~~.00241~~	.260 ~~.309~~	277.02 ~~277.07~~	
		276.90	1925 ~~1750~~	.04156 ~~.0457~~	.00173 ~~.00209~~	.221 ~~.268~~	276.98 ~~277.03~~	
		276.93 ~~276.95~~	2190 ~~1800~~	.03653 ~~.0446~~	.00133 ~~.00181~~	.171 ~~.23~~	276.93 ~~276.99~~	OK
		~~276.98~~	~~1990~~	~~.0402~~	~~.00161~~	~~.206~~	~~276.97~~	~~OK~~
See Sh 25-26 for W.S. Prof. Comps thru 48" RCP								
5+57		277.~~68~~ 39						
5+28	29'	277.~~69~~ 41	3300 ~~4160~~	.02424 .0192	.000587 .00037	.017 .011	277.41 ~~277.69~~	OK
4+46	82'	277.~~70~~ 45	3780 ~~4250~~	.02116 ~~.0188~~	.000447 ~~.000354~~	.037 ~~.029~~	277.45 ~~277.72~~	OK
		~~277.72~~	~~4300~~	~~.0186~~	~~.000345~~	.028	277.72	~~OK~~

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SCS-344 5-57
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Sh 22 of

FARM BROOK - SITE #1

W.S. Profile for T.W. on Princ. Spwy

Q = 90 cfs

SECTION	L	Elev E_1	K_d	$S^{1/2}$	S	H_1	Elev E_2	
4+46		277.~~72~~ 43						
3+47	99'	277.~~74~~ .48	~~4800~~ 5700	.01667 ~~.014~~	.000277 ~~.000197~~	.027 ~~.0195~~	277.~~74~~ 48	OK
See Sh 27 for W.S. Comps thru Durbar Hill Rd Culverts								
2+69		279.90 ~~280.14~~						
2+30	31'	279.90 ~~280.14~~	8350 9600	.00958 ~~.0083~~	.000091 ~~.000064~~	~~.0025~~	279.90 ~~280.14~~	OK
1+29	109'	279.90 ~~280.14~~	7700 ~~7300~~	.010337 ~~.0096~~	.000107 ~~.000074~~	.0117 ~~.008~~	279.91 ~~280.15~~	OK
0+18	111	279.9	7600	0.01052	0.000111	0.012	279.91	OK
-1+00	118	279.92	6700	0.01195	0.000143	0.0169	279.92	OK
-2+00	100	279.95 OK	5400	0.0148	0.000219	0.0219	279.94	OK

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Farm Brook Site #1

W.S. Profile for Tailwater on Prin. Spwy.

continuation of Q=70 cfs profile from sht. 21 – reqd. due to relocation of dam further upstream

WHL 3-29-72

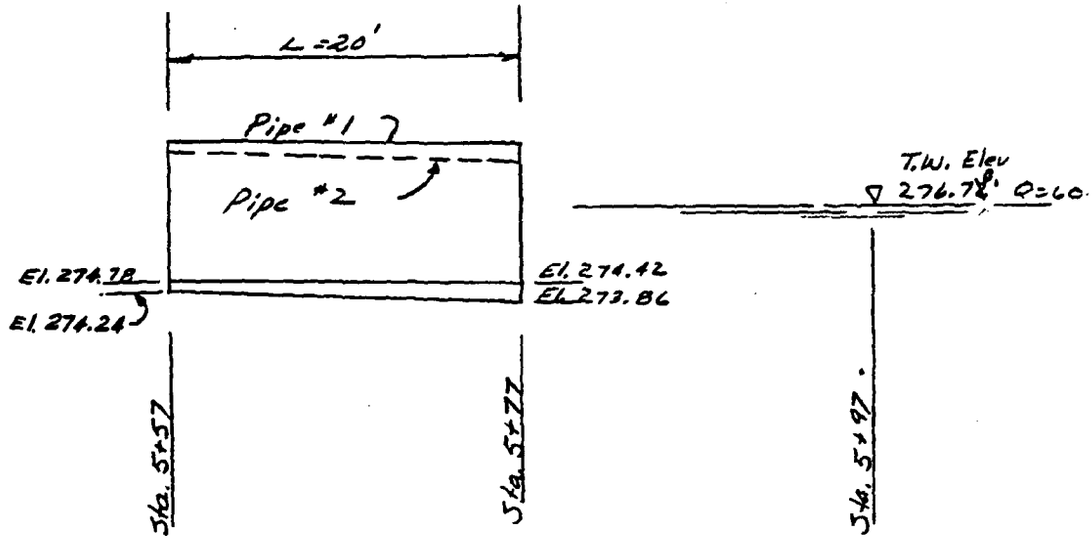
sta.	L	W.S. elev. E_1	K_d	$S_f^{1/2}$	S_f	H_1	W.S. Elev. E_2	
1+29		279.17						
0+18	111'	279.25	4850	0.0144	0.00208	0.23	~~279.40~~	
		279.30	5000	0.014	0.00196	0.22	~~279.39~~	
		279.33	5150	0.0136	0.00185	0.21	279.38	
		279.35	5250	0.0133	0.00177	0.20	279.37	OK
		(PC)						
−1+00	118'	279.5	4900	0.0143	0.00204	0.24	~~279.59~~	
		279.55	5150	0.0136	[illegible]	[illegible]	279.57	OK
−2+00	100	279.8	4900		0.00204	0.20	~~279.75~~	
		279.7	4600	0.0152	0.00231	0.23	279.78	
		USE	279.8 @ downstream end of					
		outlet channel (−2+00 & bronk)						

U. S. GOVERNMENT PRINTING OFFICE: 1959 O - 507093

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GPO 1958 O—470867

STATE		PROJECT		
CONN.		FARM BROOK W. S. - SITE #1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WTF	4-11-67	RA	6/69	
SUBJECT	Sketch of Twin 48" RCP's at Paradise Game Farm		SHEET 23 OF	



Pipe #1 Inlet Inv. Elev. = 274.78'

Outlet Inv. Elev. = 274.42'

$S = \frac{.36'}{20'} = .018'/ft$

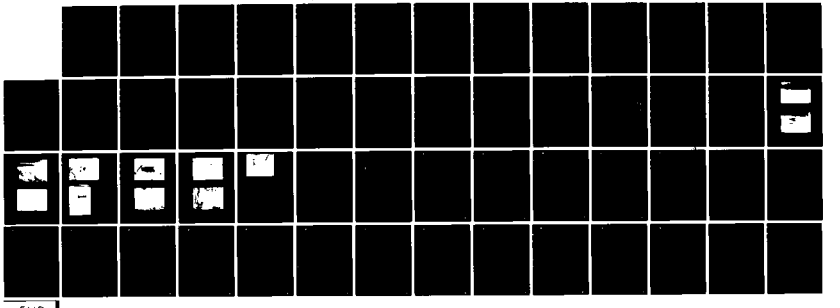
Pipe #2 Inlet Inv. Elev. = 274.24'

Outlet Inv. Elev. = 273.86'

$S = \frac{.38'}{20'} = .019'/ft$

AD-A144 583 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
FARM BROOK DAM (SITE 1.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV MAY 81

UNCLASSIFIED F/G 13/13 NL



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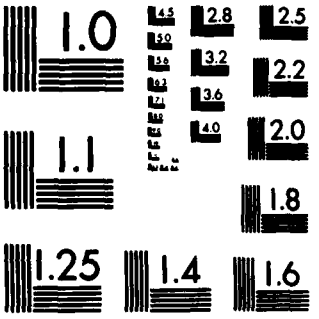


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470067

STATE		PROJECT		
CONN		FARM BROOK - SITE #1		
BY WTF	DATE 4-11-67	CHECKED BY RM	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Thru 48" R.C.P. - Q = 60 cfs				SHEET 24 OF

h_L = Total Head Loss $= h_e + h_v + h_f$

where h_e = Entrance Loss $= K_e \frac{V^2}{2g}$ and $K_e = 0.5$

$h_v = \frac{V^2}{2g}$

h_f = Friction Loss $= \frac{n^2 V^2 L}{2.21 \times r^{4/3}}$ and $n = .015$

$= \cancel{.000203}\ \cancel{.00204}\ \frac{V^2}{r^{4/3}}$

$Q_{TOTAL} = 60$ cfs

$Q_T = Q_1 + Q_2 = 60$ cfs

1. Try $Q_1 = 26$ cfs

$D = \cancel{2.30}\ 2.28$

$D/d = \cancel{.575}\ 0.570$

$C_a = .46\cancel{7}2$ (King's 7-41)

$a = C_a d^2 = .46\cancel{7}2(4)^2 = 7.\cancel{48}\ 39$

$v = Q/a = 3.\cancel{48}\ 52$ fps

$V^2/2g = .\cancel{188}\ .192$

$C_r = \cancel{.2715}\ .270$

$r = C_r d = .\cancel{2715}\ .270(4) = 1.08\cancel{4}$

$r^{4/3} = \cancel{1.116}\ 1.108$

$h_e = .5(.\cancel{188}\ .192) = .09\cancel{4}6$

$h_v = .\cancel{188}\ .192$

$h_f = .\cancel{000203}\ .00204\ \frac{3.\cancel{48}\ 52}{\cancel{1.116}\ 1.108} = .\cancel{0022}\ .0228$

$h = .09\cancel{4}6 + .\cancel{188}\ .192 + .\cancel{0022}\ .0228 = .\cancel{2842}\ .3108$

$Q_2 = 34$ cfs

$D = 2.8\cancel{6}4$

$D/d = .\cancel{715}\ 0.710$

$C_a = .\cancel{600}\ .596$

$a = .\cancel{600}\ .596(4)^2 = 9.\cancel{6}\ 54$

$v = 3.5\cancel{4}6$ fps

$V^2/2g = .19\cancel{5}7$

$C_r = .298\cancel{4}$

$r = .298\cancel{4}(4) = 1.19\cancel{4}2$

$r^{4/3} = 1.26\cancel{7}4$

$h_e = .5(.\cancel{195}\ .197) = .\cancel{0975}\ .0985$

$h_v = .19\cancel{5}7$

$h_f = .\cancel{000203}\ .00204\ \frac{3.5\cancel{4}6^2}{1.26\cancel{7}4} = .\cancel{0020}\ .0205$

$h = .09\cancel{7}8 + .19\cancel{5}7 + .0020\ .0205 = .\cancel{2945}\ .3160$

NG

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470067

STATE Conn		PROJECT Farm Brook - Site #1		
BY WTF	DATE 4-13-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comps through 48"RCP - 60 c/s				SHEET 25 OF

2. Try $Q_1 = 26.5$ $Q_2 = 33.5$

$v = 3.5\overset{86}{\cancel{45}}$ $v^2 = 12.\overset{96}{\cancel{55}}$ $v = 3.\overset{51}{\cancel{49}}$ $v^2 = 12.\overset{33}{\cancel{13}}$

$h_v = .\cancel{195}$ .1947 $h_v = .\cancel{189}$ .1915

$h_c = .\cancel{0975}$ .0944 $h_c = .\cancel{0945}$ .0938

$h_f = .0223$ .0237 $h_f = .\cancel{0019}$ .0199

$h = .\cancel{2948}$ .3233 $h = .\cancel{2854}$ .3072

Ave $h_{(Trial\ 1\ \&\ 2)} = .\cancel{2895}$ .3178 Ave $h_{(Trial\ 1\ \&\ 2)} = .\cancel{2849}$ .3116

$\therefore h = .29$

H.W. Elev. = 276.72 + .29 = 277.01 at Sta. 5+57

3. Try $Q_1 = 26.1$ $Q_2 = 33.9$

$v = 3.532$ $v^2 = 12.47$ $v = 3.553$ $v^2 = 12.63$

$h_v = .1937$ $h_v = .1961$

$h_c = .0968$ $h_c = .0980$

$h_f = .0230$ $h_f = .0204$

$h = .3135$ $h = .3145$

Use $h = 0.31$

H.W Elev = 276.70 + 0.31 = 277.01 @ Sta. 5+57

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn		PROJECT FARM Pond - Site #1		
BY WTF	DATE 4-12-67	CHECKED BY RH	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comp. thru Dunbar Hill Rd Culverts				SHEET 26 OF

3 Conduits under Dunbar Hill, partially silted in:

1 30" I.D. VCP
2 24" I.D. RCP Length = 70'±

Conduits will be submerged by tailwater, so flow area at entrance will be net area above silt — assume constant thru pipes

Pipe #1 (30" VCP) Inlet Invert Elev. = 274.33, Elev. silt level = 274.9

Depth of silt = .57', $\frac{D}{d} = \frac{.57'}{2.5'} = .228$ $C_a = .1348$ $a = .843^{\square'}$

Area of 30" Pipe = $4.91^{\square'} - .84^{\square'} = \underline{4.07}^{\square'}$ net area

Pipe #2 (24" RCP) In. Inv. = 274.49, Elev. silt = 275.0

Depth silt = .51', $\frac{D}{d} = \frac{.51}{2} = .255$, $C_a = .1579$ $a = .632^{\square'}$

Area 24" RCP = $3.142 - .632 = \underline{2.51}^{\square'}$ net area

Pipe #3 (24" RCP) - Inv. In = 274.43, Elev. silt = 274.7

Depth silt = .27' $\frac{D}{d} = \frac{.27'}{2'} = .135$, $C_a = .0634$, $a = .254^{\square'}$

Area 24" RCP = $3.142 - .254 = 2.888 = \underline{2.89}^{\square'}$ net area

Entrance Loss, $h_e = K_e \frac{V^2}{2g}$ where $K_e = 0.15$

Friction Loss, $h_f = K_p L \frac{V^2}{2g}$, where K_p for $n = .015$ = .01228 (30" I.D.)
.0165 (24" I.D.)

$$Q = K_T a \sqrt{2gH}$$

where $K_T = \frac{1}{\sqrt{1 + K_e + K_p L}}$

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—478867

STATE		PROJECT		
CONN		FARM BROOK - SITE #1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WTF	4-12-67	RA	6/67	
SUBJECT				SHEET 27 OF
W.S. Prof. Comps. thru Dunbar Hill Rd Culverts				

Pipe #1 $Q_1 = \frac{1}{\sqrt{1+.15+.01228(70)}} \times 4.07 \times 8.02\sqrt{H} = 23.02\sqrt{H}$

Pipe #2 $Q_2 = \frac{1}{\sqrt{1+.15+.0165(70)}} \times 2.51 \times 8.02\sqrt{H} = 13.26\sqrt{H}$

Pipe #3 $Q_3 = \frac{1}{\sqrt{1+.15+.0165(70)}} \times 2.89 \times 8.02\sqrt{H} = 15.27\sqrt{H}$

$Q_T = 60\ cfs = Q_1 + Q_2 + Q_3$

By Trial & Error:

(1.) $Q_1 = 26$ $Q_2 = 16$ $Q_3 = 18$

$H_1 = \frac{Q_1^2}{23.02^2}$ $H_2 = \frac{Q_2^2}{13.26^2}$ $H_3 = \frac{Q_3^2}{15.27^2}$

$= .00189 \cdot Q_1^2$ $= .00569 \cdot Q_2^2$ $= .00429 \cdot Q_3^2$

$H_1 = 1.28'$ $H_2 = 1.46'$ $H_3 = 1.39'$ N.G. ✓

(2) $Q_1 = 26.8$ $Q_2 = 15.5$ $Q_3 = 17.7$

$H_1 = 1.36'$ $H_2 = 1.37'$ $H_3 = 1.354$ OK

Say $H = 1.36'$

$\therefore$ Elev. = $277.08' + 1.36' = \underline{278.44'}$ at Sta. 2+69.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn		PROJECT Farm Brook - Site #1		
BY WTF	DATE 4-12-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comp. thru 48" RCP - 70 cfs.				SHEET 28 OF

See Sh ~~*~~ 18 for Constants

T.W. Elev. = 276.8~~5~~3

Pipe #1, D = 276.8~~5~~3 - 274.42 = 2.4~~3~~1'

Pipe #2, D = 276.8~~5~~3 - 273.86 = 2.9~~9~~7'

1. Try Q_1 = 30 cfs

$D/d = \frac{2.4\cancel{3}1}{4} = .60\cancel{7}5$

$C_a = .\cancel{500}\ .494$ $a = \cancel{8.00}\ 7.90\ d'$

$C_r = .\cancel{280}\ .279$ $r = 1.12$

$r^{4/3} = 1.163$

$v = \frac{30}{\cancel{8.0}\ 7.90} = 3.\cancel{75}\ 80$, $v^2 = 14.\cancel{05}\ 42$

$h_v = \frac{v^2}{2g} = .\cancel{210}\ .224$

$h_e = .5\frac{v^2}{2g} = .\cancel{109}\ .112$

$h_f = \frac{\cancel{.000203}\ .00204}{1.163} v^2 = .\cancel{245}\ .0253$

$h = .\cancel{672}\ .3613$

Q_2 = 40 cfs

$D/d = \frac{2.9\cancel{3}7}{4} = .74\cancel{7}5$

$C_a = .\cancel{630}\ .625$ $a = \cancel{10.07}\ 10.00\ d$

$C_r = .302$ $r = 1.21$

$r^{4/3} = 1.289$

$v = \frac{40}{10.0\cancel{7}0} = \cancel{3.97}\ 4.00$ $v^2 = \cancel{15.75}\ 16.00$

$h_v = \frac{v^2}{2g} = .24\cancel{5}8$

$h_e = .5\frac{v^2}{2g} = .12\cancel{25}\ 42$

$h_f = \frac{\cancel{.000203}\ .00204}{1.289} v^2 = .\cancel{248}\ .0253$

$h = .\cancel{616}\ .3975$

2. Try Q_1 = 32

$v = \cancel{4.00}\ 4.05$, $v^2 = \cancel{16.00}\ 16.41$

$h_v = .\cancel{248}\ .2548$

$h_e = .\cancel{124}\ .1274$

$h_f = .\cancel{279}\ .0288$

$h = .\cancel{651}\ .4110$

Q_2 = 38

$v = 3.\cancel{78}\ 80$ $v^2 = 14.\cancel{25}\ 44$

$h_v = .22\cancel{15}\ 42$

$h_e = .\cancel{111}\ .1121$

$h_f = .\cancel{2245}\ .0229$

$h = .\cancel{557}\ .3592$

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470067

STATE		PROJECT		
BY	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT				SHEET 29 OF

3. Try $Q_1 = 31$

$v = 3.87$ (92) $v^2 = 15.04$ (40)

$h_v = .2391$ (.2393)

$h_e = .1196$ (.1165)

$h_f = .0270$ (.0262)

$h = .3857$ (.3820)

$Q_2 = 39$

$v = 3.87$ (90) $v^2 = 15.04$ (21)

$h_v = .2362$ (.2393)

$h_e = .1181$ (.1165)

$h_f = .0241$ (.0236)

$h = .3784$ (.3761)

4. Try $Q_1 = 30.5$

$v = 3.851$ (61) $v^2 = 14.84$ (91)

$h_v = .2315$ (.2325)

$h_e = .1157$ (.1125)

$h_f = .0262$ (.0253)

$h = .3734$ (.3703)

$Q_2 = 39.5$

$v = 3.945$ $v^2 = 15.60$

$h_v = .2423$

$h_e = .1211$

$h_f = .0247$ (.0246)

$h = .3881$ (.3809)

Say $h = .38$ (.60)

Elev. at 5+57 = 276.82 + .38 = 277.20 (277.1)

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470667

STATE CONN		PROJECT FARM BROOK - SITE #1		
BY WTF	DATE 4-12-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comps. thru Dunbar Hill Rd. - 70 ch				SHEET 30 OF

See Sh. ~~X~~ 20-21 for Constants

$H_1 = .00189 \cdot Q_1^{2}$ $H_2 = .00569 \cdot Q_2^{2}$ $H_3 = .00429 \cdot Q_3^{2}$

1. Try $Q_1 = 30$ $Q_2 = 18$ $Q_3 = 22$

$H_1 = 1.70'$ $H_2 = 1.84'$ $H_3 = 2.07'$ N.G.

2. Try $Q_1 = 32$ $Q_2 = 18$ $Q_3 = 20$

$H_1 = 1.94'$ $H_2 = 1.84'$ $H_3 = 1.72'$

3. Try $Q_1 = 31$ $Q_2 = 18$ $Q_3 = 21$

$H_1 = 1.82'$ $H_2 = 1.84'$ $H_3 = 1.89'$

Say $H = 1.85'$

Elev. at Sta 2+69 = 277.~~54~~ 28 + 1.85 = 279.~~39~~ 13

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470067

STATE		PROJECT		
CONN		FARM BROOK - SITE #1		
BY WTF	DATE 4-12-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Profile Comps thru 48" RCP - 80 cfs				SHEET 31 OF

T.W. Elev. = 276.~~98~~ 93

Pipe #1, D = 276.9~~8~~3 - 274.42 = 2.5~~4~~1'

Pipe #2, D = 276.9~~8~~3 - 273.86 = 3.~~12~~07'

1. Try $Q_1 = 34$

$D/d = .\cancel{640}\ .6275$

$C_a = .\cancel{531}\ .519$ $a = \cancel{8.5}\ 8.304'$

$C_r = .\cancel{286}\ .2835$ $r = \cancel{1.143}\ 1.134$

$r^{4/3} = \cancel{1.195}\ 1.1825$

$v = 4.\cancel{00}\ .094$ $v^2 = \cancel{16.0}\ 16.764$

$h_v = \cancel{.249}\ .2603$

$h_e = \cancel{.1245}\ .1302$

$h_f = \frac{.000203}{\cancel{1.195}\ 1.1825} v^2 = .\cancel{00017}\ .001725\ v^2$

$= \cancel{.272}\ .0289$

$h = .\cancel{646}\ .4194$

$Q_2 = 46$

$D/d = .\cancel{780}\ .7675$

$C_a = .\cancel{657}\ .647$ $a = \cancel{10.56}\ 10.352$

$C_r = .\cancel{304}\ .30275$ $r = \cancel{1.216}\ 1.211$

$r^{4/3} = \cancel{1.298}\ 1.2908$

$v = \cancel{4.38}\ 4.444$ $v^2 = \cancel{19.16}\ 19.745$

$h_v = .\cancel{298}\ .3066$

$h_e = .\cancel{149}\ .1533$

$h_f = \frac{.\cancel{000203}\ .00204}{\cancel{1.290}\ 1.2908} v^2 = .\cancel{0001564}\ .00158\ v^2$

$= .\cancel{300}\ .0312$

$h = .\cancel{947}\ .4911$ NG

2. Try $Q_1 = 36$

$v = \cancel{4.24}\ 4.335$ $v^2 = \cancel{17.9}\ 18.794$

$h_v = .\cancel{278}\ .2918$

$h_e = .\cancel{139}\ .1459$

$h_f = .\cancel{304}\ .0324$

$h = .\cancel{721}\ .4701$

$Q_2 = 44$

$v = \cancel{4.19}\ 4.250$ $v^2 = \cancel{17.5}\ 18.066$

$h_v = .\cancel{272}\ .2805$

$h_e = .\cancel{136}\ .1403$

$h_f = .\cancel{274}\ .0286$

$h = .\cancel{682}\ .4494$ N.G.

COMPUTATION SHEET
SCS-523 · REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
CONN		FARM BROCK - SITE #1		
BY WTF	DATE 4-12-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comps thru 48" RCP - 80 ft				SHEET 32 OF

3. Try $Q_1 = 35$

$v = \cancel{4.12}\ 4.215$ $v^2 = 16.95\ 17.765$

$h_v = \cancel{.263}\ .2759$

$h_e = \cancel{.1315}\ .1379$

$h_f = \cancel{.288}\ .0306$

$h = \cancel{.685}\ .4444$

$Q_2 = 45$

$v = \cancel{4.28}\ 4.347$ $v^2 = \cancel{18.3}\ 18.896$

$h_v = \cancel{.284}\ .2934$

$h_e = \cancel{.142}\ .1467$

$h_f = \cancel{.286}\ .0299$

$h = \cancel{.712}\ .4700$ N.G.

~~Say h = .70~~

~~W.S. Elev. at 5+57 = 276.98 + .70 = 277.68~~

4. Try $Q_1 = 35.5$

$v = 4.275$ $v^2 = 18.276$

$h_v = .2838$

$h_e = .1419$

$h_f = .0315$

$h = .4572$

$Q_2 = 44.5$

$v = 4.299$ $v^2 = 18.479$

$h_v = .2869$

$h_e = .1435$

$h_f = .0292$

$h = .4596$ N.G.

5. Try $Q_1 = 35.6$

$v = 4.287$ $v^2 = 18.379$

$h_v = .2854$

$h_e = .1427$

$h_f = .0317$

$h = .4598$

$Q_2 = 44.4$

$v = 4.289$ $v^2 = 18.396$

$h_v = .2856$

$h_e = .1428$

$h_f = .0291$

$h = .4575$ OK

Use $h = .46$

W.S. Elev @ 5+57 = 276.93 + 0.46 = 277.39

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470667

STATE Conn		PROJECT FARM Brook - Site #1		
BY WTF	DATE 4-12-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. Comps thru Dunbar Hill Rd - 80 ft				SHEET 33 OF

See Sh. 20-21 for constants

$H_1 = .00189\,Q_1^2$ $\quad H_2 = .00569\,Q_2^2$ $\quad H_3 = .00429\,Q_3^2$

1. Try $Q_1 = 36$ $\quad Q_2 = 21$ $\quad Q_3 = 23$

$H_1 = 2.45$ $\quad H_2 = 2.51$ $\quad H_3 = 2.27$

2. Try $Q_1 = 36$ $\quad Q_2 = 20$ $\quad Q_3 = 24$

$H_1 = 2.45$ $\quad H_2 = 2.28$ $\quad H_3 = 2.47$

3. Try $Q_1 = 36$ $\quad Q_2 = 20.2$ $\quad Q_3 = 23.8$

$H_1 = 2.45$ $\quad H_2 = 2.32$ $\quad H_3 = 2.43$

4. Try $Q_1 = 35.6$ $\quad Q_2 = 20.7$ $\quad Q_3 = 23.7$

$H_1 = 2.40$ $\quad H_2 = 2.44$ $\quad H_3 = 2.41$

Say $H = 2.42'$

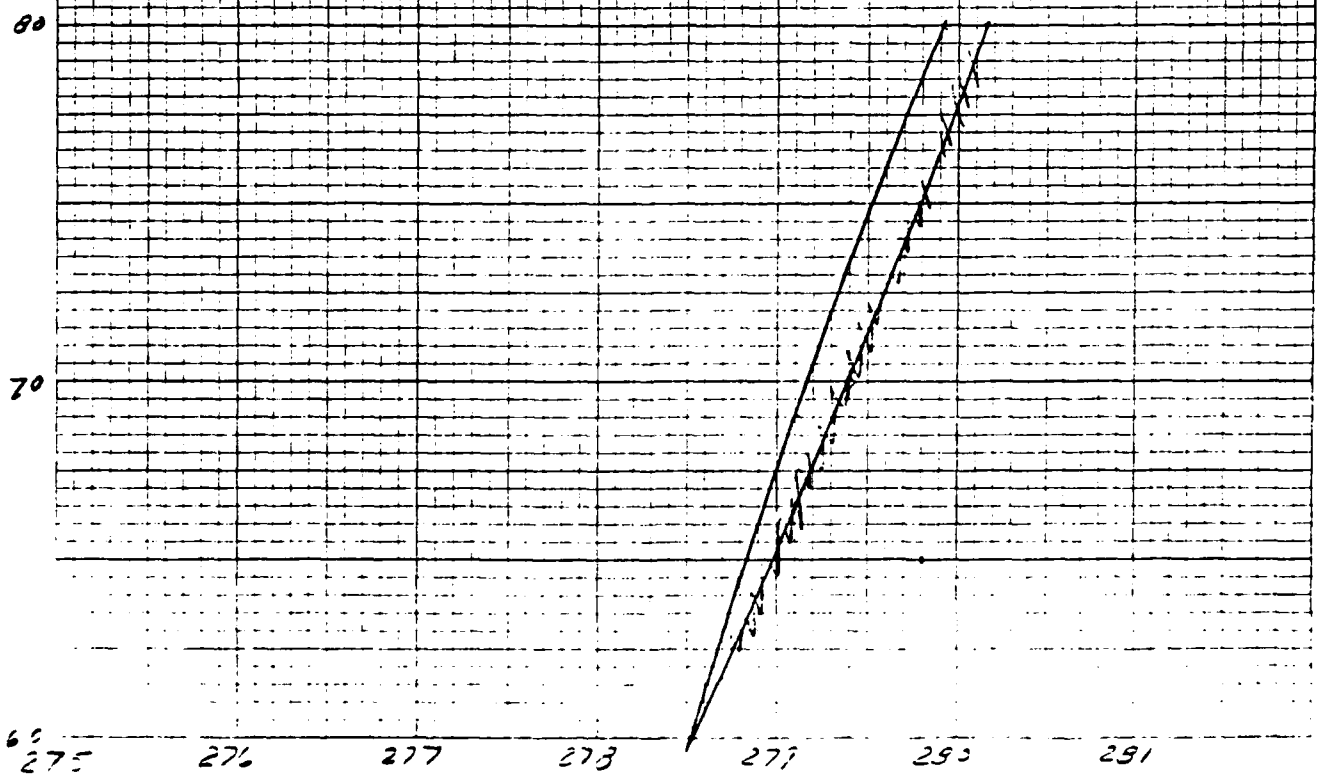
Elev. at $2+69 = 277.48 + 2.42 = 279.90$ ~~280.14~~

Fisher Brook W.S. = Site #1

Stage - Discharge Curve

at Station 1+29

RA 6/67



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COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470067

STATE Conn		PROJECT Farm Brook #1		
BY W. T. F	DATE 5-15-67	CHECKED BY RA	DATE 6/67	JOB NO.
SUBJECT W.S. Prof. thru prismatic channel to P.S.				SHEET 35 OF

Note:

Stationing of Farm Brook by WPP was referenced to ℄ of Dunbar Hill Rd. and called 3+00.

Intersection of ℄ proposed dam and ℄ of P.S. is called Sta 2+00 P.S. in final design

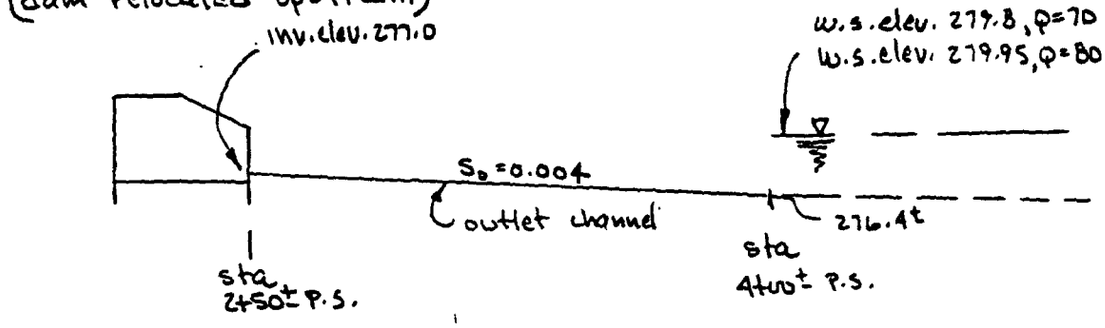
Sta ~~5+50~~ 7+20± P.S. is approximately at Sta. 1+29 of Farm Brook.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn		PROJECT Farm Brook Sit. 1		
BY WHL	DATE 3-29-72	CHECKED BY	DATE	JOB NO. CN-428-H
SUBJECT Tailwater - Outlet Channel				SHEET 36 OF

(dam relocated upstream)



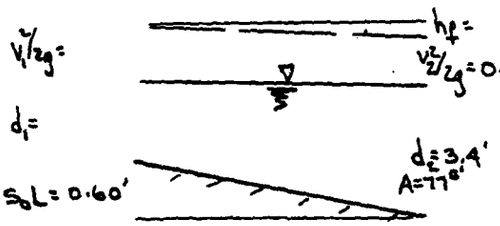
try outlet channel - B=12', S=0.004, Z=2, n=0.04

check d_n for Q=70 cfs

$$AR^{2/3} = \frac{Qn}{1.486 S_o^{1/2}} = \frac{(70)(0.04)}{1.486(0.0634)} = 29.8$$

d=1.6 A=24.3 R=1.27 $AR^{2/3}$=28.5
d=1.7 A=26.2 R=1.33 $AR^{2/3}$=31.7

$\therefore d_n = 1.6'$ will not be attained



$V_2 = \frac{70}{77} = 0.91$'/sec (Sh. 16B) R=2.3 $R^{4/3}$=3.04

$V_2^2/2g$=0.013'

$S_f = \frac{V^2 n^2}{2.21 R^{4/3}} = \frac{(0.83)(0.0016)}{(2.21)(3.04)} = 0.000198$

try d_1=3' A_1=54 sq ft V_1=1.3'/sec $V_1^2/2g$=0.026'

R=2.12 $R^{4/3}$=2.72

$S_{f_1} = \frac{1.69(0.0016)}{2.21(2.72)} = 0.00045$ avg. S_f=0.000324 h_f=0.05'

$V_1^2/2g$ =	0.026	$V_2^2/2g$ =	0.013
d_1 =	3.0	d_2 =	3.4
$S_o L$ =	0.60 / 3.626'	h_f =	0.05 / 3.563'

$\therefore$ T.W. elev. 280.0 @ outlet basin for Q=70 cfs

USE T.W. elev. 280.0 for $Q \leq 80$ cfs

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

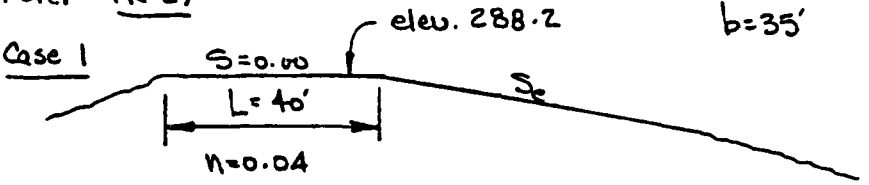
GPO 1958 O—470067

STATE		PROJECT		
Conn		Farm Brook Site 1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WHL	12-27-71			CN-428

SUBJECT Revised Emergency Spillway Hydraulics — SHEET 41 OF

Refer- TR-39

Case 1



H_p	H_{ec}	Q_{em}	d_c	W.S. Elev.	Q_p	Tot. Q
0 ft	0 ft	0 cfs	0 ft	288.2	71 cfs	71 cfs
0.2						
0.4		11		288.6	72	83
0.6	0.38	26	0.26	288.8	73	99
0.8	0.56	47	0.38	289.0	74	121
1.0	0.74	72	0.50	289.2	74	146
1.5	1.21	153	0.82	289.7	76	229
2.0	1.68	258	1.16	290.2	78	336
3.0	2.66	540	1.85	291.2	80	620

note- revision of pipe flow will not materially effect routings - see sht 37

routed DHW elev. 289.0

emer spwy crest elev. 288.2 $\therefore H_p = 0.8'$

$H_{cc} = 0.56'$ (ES 171, 1/10) $d_c = 0.38'$

$Q_{es} = 121 \text{ cfs} - 74_{(pipe)} = 47 \text{ cfs}$

$S_{c.1/4} = 4.4\%$ (ES 170.1/4) USE $S_e = 4\%$ (EM-27)

@ control section: $d_c = 0.38'$ $b = 35'$

$A_c = 35(0.38) = 13.3^{a'}$ (negl. side slopes)

$V_c = \frac{47}{13.3} = 3.53$ 1/sec

in exit channel: $S_e = 0.04$ 1/1 use unit width basis -

$A_e = d_e \times 1$ $P = 1$ $R = d_e$

$Q/_b = \frac{1.486}{n} A R^{2/3} S^{1/2} = \frac{1.486}{0.04}(d_e)(d_e^{2/3})(0.04)^{1/2} = 7.43\, d_e^{5/3}$

$d_e = \left(\frac{47/35}{7.43}\right)^{3/5} = 0.18^{3/5} = 0.36'$

$V_e = \frac{47/35}{0.36} = 3.73$ 1/sec

allow V = 125% (5 1/sec) = 6.25 1/sec OK

Summary - pertinent elevations:

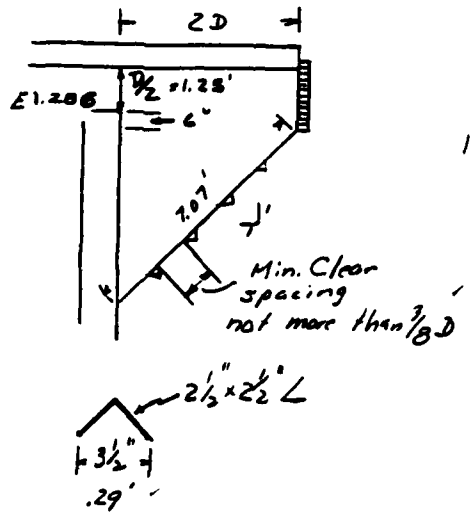
Recreation Pool	elev. 286.0
Crest Emer. Spwy	288.2
D.H.W. Elev.	289.0
Freeboard Routing	290.7
Top of Dam Elev.	291.0

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1956 O—470067

STATE		PROJECT		
CONN		FARM BROOK #1		
BY	DATE	CHECKED BY	DATE	JOB NO.
WTF	3-25-67	D.S.	2/7/68	CN-42E-H
SUBJECT				SHEET 49 OF
Riser Modification				



Standard Riser for 30" I.D. Cond.

2D = 5.0'

1.414 × 5 = 7.07' along plane of trash rack

3D = 7.5' = Length of Riser inside

Total Area = 7.07 × 7.5 = 53.1 Sq. ft.

Q_{max} = 72 cfs = 36 cfs for ½ riser

Max. allow. v = 2.0 fps

Net Area Req. = $\frac{36}{2.0}$ = 18 Sq. ft.

.29 × 7.5 = 2.18 Sq. ft. = Area of one ∠ of trash rack

Min. Spacing = $\frac{3}{8}$ D = .375 × 2.5 = .94 ft

n = no. ∠ irons, .29' wide

Clear length along plane of trash rack = 7.07' − n(.29)

Also, = .94(n+1)

$\therefore$ 7.07 − n(.29) = .94(n+1)

7.07 − .29n = .94n + .94

1.23n = 6.13

n = 5

Total area occupied by 5 bars = 5 × 2.18 = 10.90 Sq. ft.

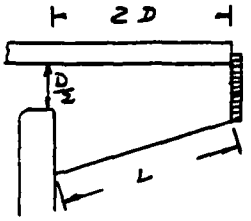
Net area = 53.1 − 10.9 = 42.2 Sq. ft. > 18.0 ft²

Raise bottom of cantilevered wings to some elevation that will clear the embankment and/or natural ground and maintain a minimum net area of 18.0 Sq. ft. or max. spacing of .94 ft.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn.		PROJECT Farm Brook #1		
BY WTF	DATE 5-25-67	CHECKED BY D.S.	DATE 2/7/68	JOB NO. CN-428-H
SUBJECT Riser Modification (Cont'd)				SHEET 50 OF



L must be ≧ 2D, or 5'

if n = 5 ∠s and max. allow. spacing = .94',

when L = 2D = 5',

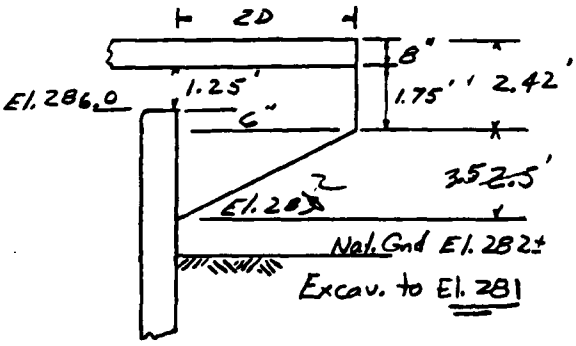
net Length, L' = 5 − 5(.29) = 3.55'

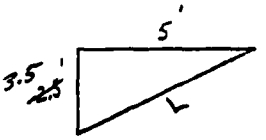
and area = 3.55 × 7.5 = 26.6 Sq. ft > 18.0 allow.

$\frac{3.55}{n+1} = \frac{3.55}{6} = .59' < .94$ max. allow, so OK

∴ any length L between 2D and 7.07' may be used, with number of angle irons necessary to keep .94' spacing

On profile of proposed Princ. Spwy, nat. ground at riser is at Elev. 282 ±, and riser crest is at 286.0





$L = \sqrt{\frac{3.5^2}{\cancel{2.5}^2} + 5^2}$

= ~~5.59'~~ say ~~5.6'~~

= 6.10'

if n = 4

L' = ~~5.6~~ 6.1 − 4(.29) = ~~4.44'~~ 4.94

and $\frac{\cancel{4.44}\ 4.94}{n+1} = \cancel{.89}\ .98' > .94'$ max. allow. say OK

∴ Net area = ~~4.44~~ 4.94 × 7.5 = ~~33.3~~ 37 Sq. ft. > 18.0 min.

OK

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

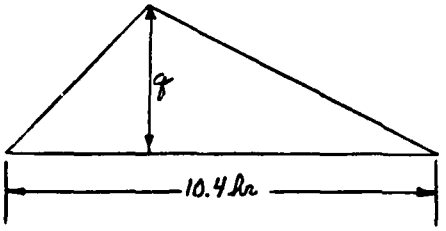
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
Conn.		Farm Brook W.S. Site 1		
BY	DATE	CHECKED BY	DATE	JOB NO.
PAR	3-23-72	WHL	3-31-72	CN-428
SUBJECT				SHEET 51 OF
Diversion Ditch Outlet				

DA ≈ 9 ac T_c = 0.15 hr

10 yr. 6 hr storm P = 3.5"
CN = 73 Q = 1.18"

$Vol = \frac{1.18}{12} \times 9 = 0.89$ AF



$\frac{1}{2}(8)(10.4) = 0.89$ AF

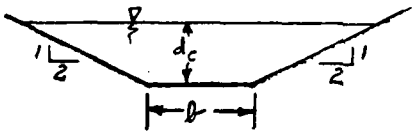
$q = \frac{1.78}{10.4} \times \frac{hr}{3600\,sec} \times \frac{43560\,ft^3}{AF} = 2.1$ cfs

$T_p = \frac{\Delta D}{2} + 0.6T_c = \frac{4}{2} + 0.9 = 3.9$
$T_b = 2.67\ (3.9) = 10.4$ hr.

w/ 6 hr base

$q = \frac{10.4}{6.0} \times 2.1 = 3.6$ cfs

$d_c = 0.32'$ for $b = 3'$

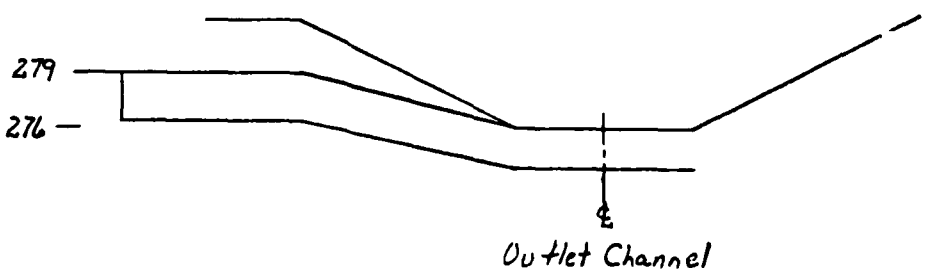


Use $b = \frac{3}{5}'$ for Riprap Chute at the outlet into the Channel

Extend riprap 10' upstream of Chute & blend to existing ditch

Chute, Riprapped See RTSC-NE-ENG 614

F = 3'
Ent. Length = 10'
Chute Slope = 4:1
Side Slopes = 2:1
Chute toe = Outlet Channel toe



COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GPO 1958 O—478667

STATE Conn		PROJECT Farm Brook Site 1		
BY WHL	DATE 3-30-72	CHECKED BY	DATE	JOB NO. CN-428-H
SUBJECT Diversion Ditch No. 1				SHEET 52 OF

W.S. area for diversion = 58 Ac (0.0906 mi²)

Time of concentration –

Reach	Length	Diff. in Elev.	Slope	Avg. Vel.	Time
1	1000'	50	5%	1.5 ft/sec	670 sec
2	400	200	50	10	40
3	300	50	17	3	100
4	1000	50	5	2	500
ditch	800±	—	—	say 4	200

1510 sec = 0.42 hr.
use 0.4 hr.

proportion ditch for 100 yr-6hr storm

P = 5.1" CN 73 Q = 2.36" Hyd. Family 3

comp. T_p = 0.7(0.4) = 0.28 T_o = 4.55 T_o/T_p = 16.2 use 16 new T_p = 0.284

$q_p = \frac{484(0.0906)}{0.284} = 154.5$ $Qq_p = 364$ peak Q = 364(0.23) = 84 cfs

try: S_o = 0.005, n = 0.032, allow. V_{max} = 4 ft/sec (veg.), Z = 3

$R^{2/3} = \frac{Vn}{1.486 S_o^{1/2}} = \frac{4(0.032)}{(1.486)(0.0707)} = 1.22$ R = 1.35 $A = \frac{84}{4} = 21$ ft²

w/ B = 12' & d = 1.5' A = 24.75 ft² $R = 1.15 \cdot R^{2/3} = 1.10$ $V = \frac{1.486}{.032}(1.10)(0.0707) = 3.61$ ft/sec Q = 89 cfs OK

∴ B = 12', Z = 3, S_o = 0.005, d = 1.5 + 0.5' freeboard = 2' OK

parabolic ditch – S_o = 0.005 R = 1.35 A = 21 ft² $\frac{A}{R^2} = 11.5$ $X = \frac{d}{T} = 0.145$
(ES41, 1/1)

$T = \sqrt{\frac{3A}{2X}} = \sqrt{\frac{3(21)}{2(0.145)}} = 14.75$ d = 2.14' $F = \frac{V}{\sqrt{gd}} = \frac{4}{8.32} = 0.48$

check – $R^{2/3} = 1.22$ $V = \frac{1.486}{.032}(1.22)(0.0707) = 4.0$ ft/sec OK

d = 2.1 + 0.5 = 2.6', S_o = 0.005, T = 14.8' @ d = 2.1' OK

COMPUTATION SHEET
SCS-ENG-523, Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn		PROJECT Farm Brook Site 1		
BY WHL	DATE 4-5-72	CHECKED BY	DATE	JOB NO. CN-428-H
SUBJECT Diversion Ditch No. 1				SHEET 53 OF

parabolic ditch - $S_o = 0.05$

check w/ $d = 1.5'$, $T = 12'$ $A = \frac{2}{3}(12)(1.5) = 12^{\square'}$ $w \approx 12'$

$R \approx 1$ $V = \frac{1.486}{0.032}(1)^{2/3}(\overset{0.224}{\cancel{0.707}}) = \overset{10.4}{\cancel{32.8}}$ '/sec $Q >> 84$ cfs

∴ provide min. depth of stone lining of 18" - more than adequate

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Conn.		PROJECT Farm Brook #1		
BY WHL	DATE 4-12-72	CHECKED BY	DATE	JOB NO. CN-428
SUBJECT Local Drainage – Borrow Area				SHEET 54 OF

DA ≈ 10 ac $T_c \approx 0.2$ hr.

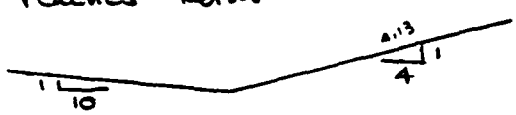
10 yr - 6 hr storm P = 3.5" CN 73

$T_p = 0.7(0.2) = 0.14$ hr Family 3 $T_o = 4.1$ $T_o/T_p = 29.3$ use 25

rev. $T_p = 0.164$ Q = 1.18"

$q_p = \frac{484(0.0156)}{0.164} = 46$ $q_p = 54$ peak Q = 0.173(54) = 9 cfs

check berm capacity assuming all RO from (8 Ac) DA reaches berm –



try 6" flow - n = 0.04 S_o = 0.01
WP = 12.1' A = 1.75 sq ft R = 0.145 $R^{2/3}$ = 0.276

$V = \frac{1.486}{0.04}(0.276)(0.1) = 1.02$ ft/sec

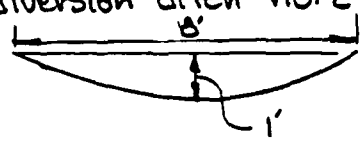
Q = 1.8 cfs < 9 cfs

try d = 1'
WP = 14.2 A = 7 sq ft R = 0.493 $R^{2/3}$ = 0.626

$V = \frac{0.626}{0.276}(1.02) = 2.32$ ft/sec Q = 16 cfs > 9 cfs

∴ ok for 2' deep berm.

diversion ditch no. 2 – (collector)



check capacity w/ min S_o = 0.005 $S_o^{1/2}$ = 0.0707

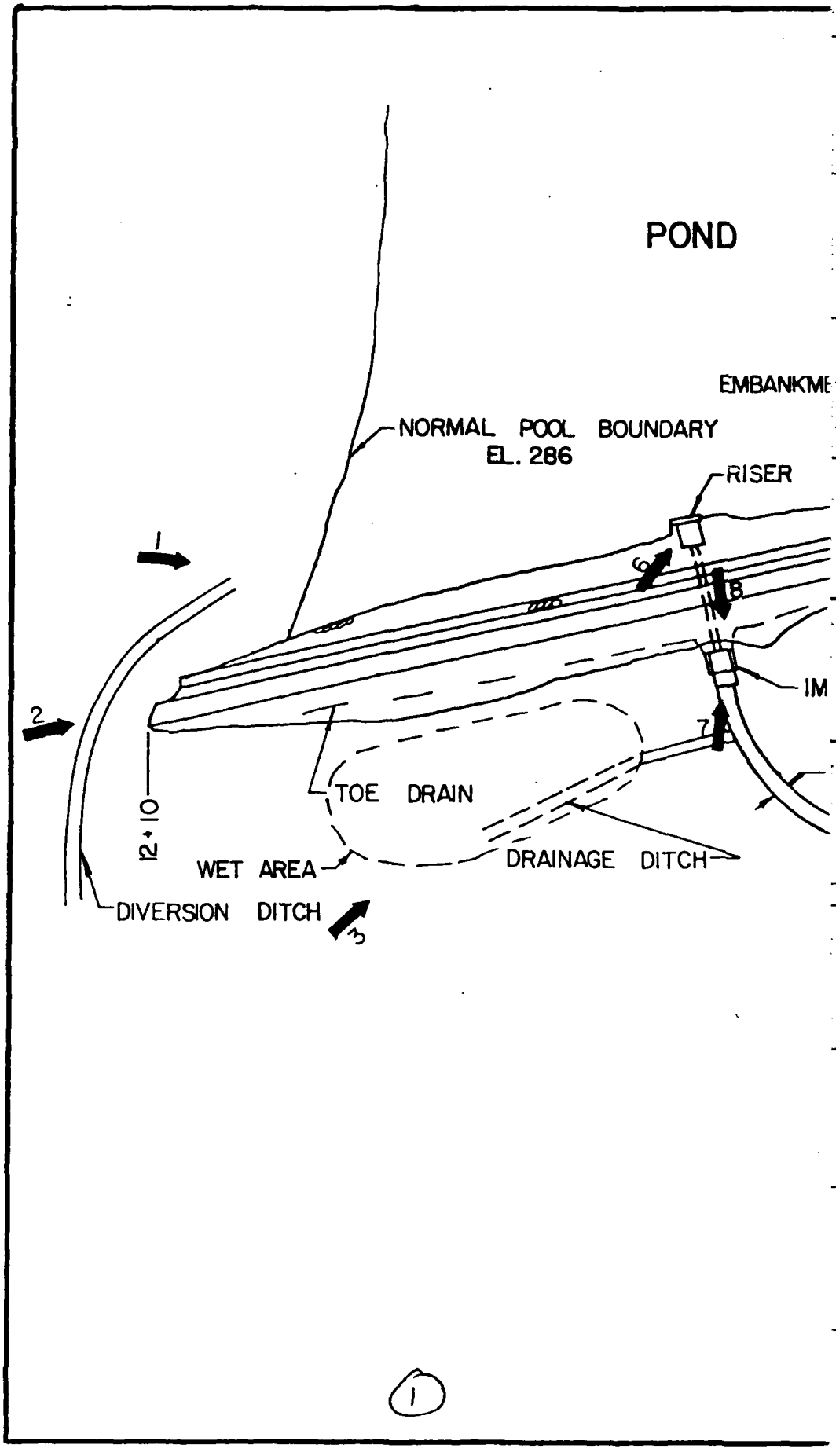
$A = \frac{2}{3}(8)(1) = 5.3$ sq ft WP = 8' R = 0.66 $R^{2/3}$ = 0.76

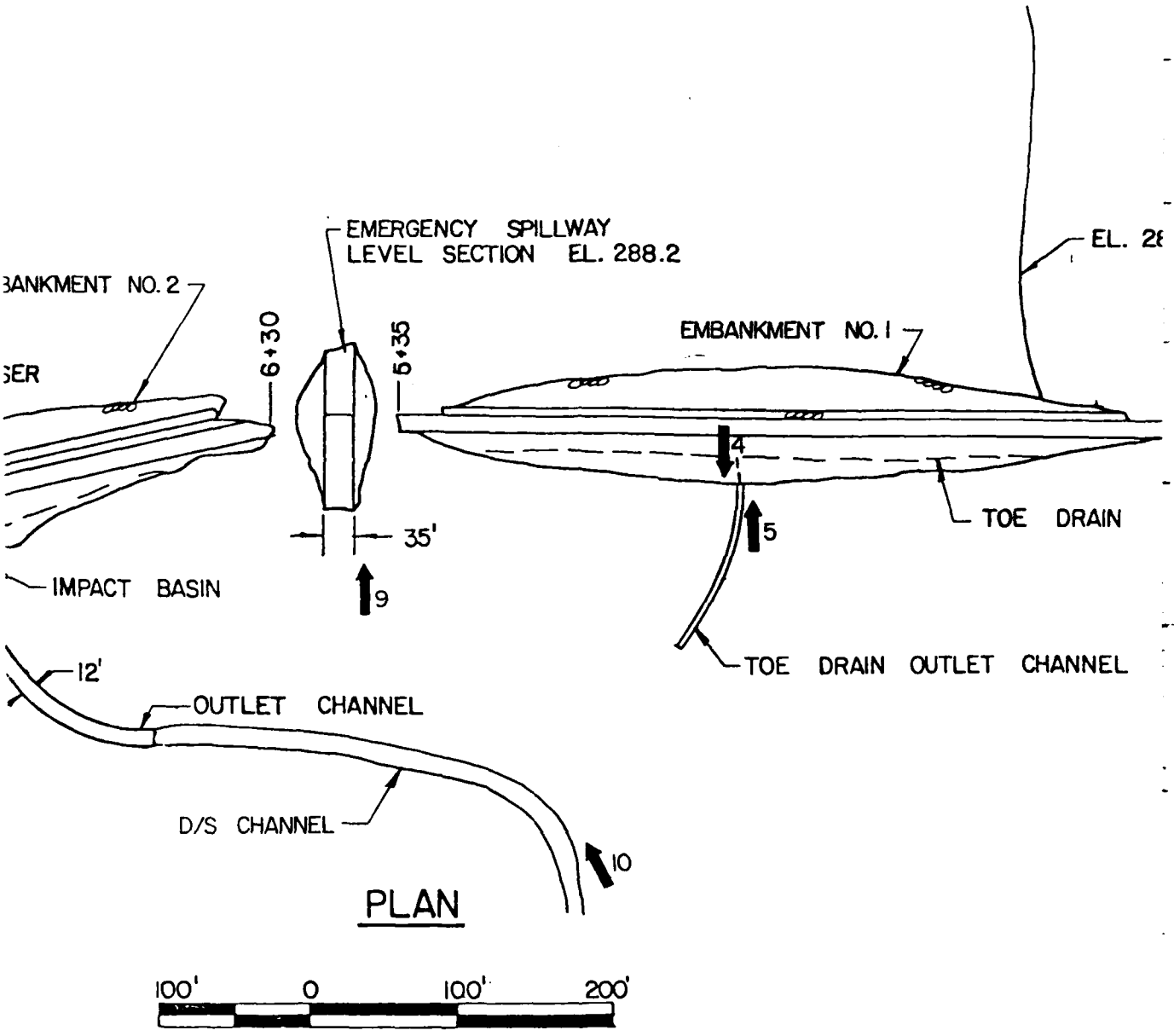
$V = \frac{1.486}{.04}(0.76)(0.0707) = 2$ ft/sec Q = 10.6 cfs > 9 cfs ok

capacity of diversion ditch no. 1 is more than adequate to carry additional drainage from Borrow Area.

APPENDIX C

PHOTOGRAPHS


POND
EMBANKME
NORMAL POOL BOUNDARY
EL. 286
RISER
1
2
3
6
8
7
IM
TOE DRAIN
12+10
WET AREA
DRAINAGE DITCH
DIVERSION DITCH



PHOTO

FARM E

(2)

INTERNATIONAL ENGINEERING COMPANY, INC.

Sheet D-5

Project NDFP Contract No. 2616-08 File No.

Feature FARM BROOK DAM, HAMDEN, CT Designed MP Date 12/12/80

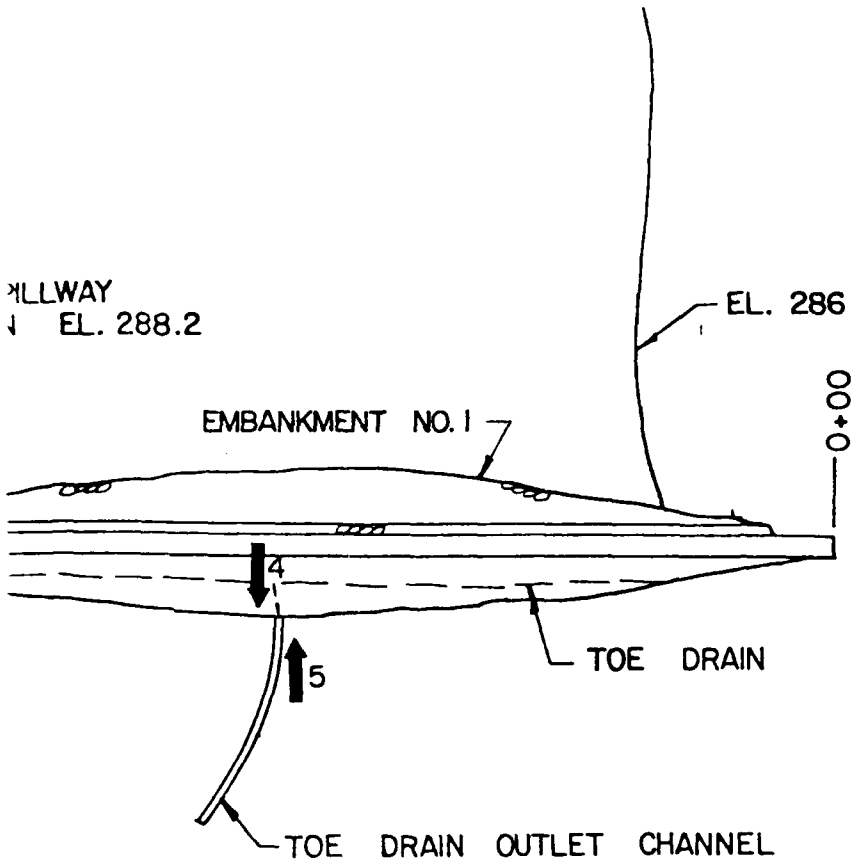


PHOTO LOCATION PLAN

FARM BROOK DAM (SITE 1)

(2)

(3)

Photo 1 Top and upstream slope of dam and riser of principal spillway.

Photo 2 Top and downstream slope of dam. Diversion ditch is in foreground.

Photo 3 Drainage ditch on toe embankment No 2.

Photo 4 Drain outlet channel at toe of embankment No. 1.

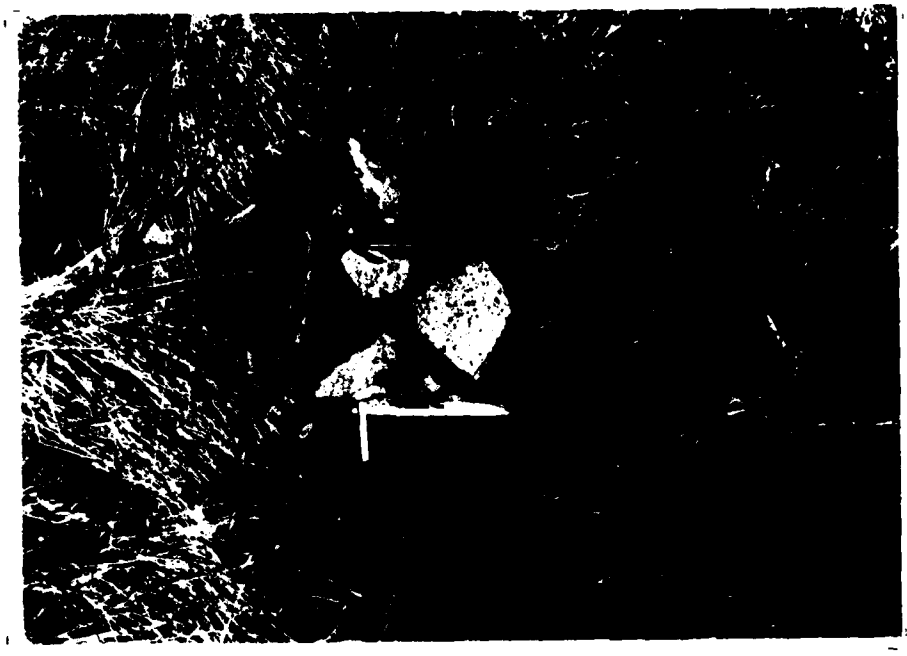


Photo 5 Toe drain outlet of embankment No. 1.

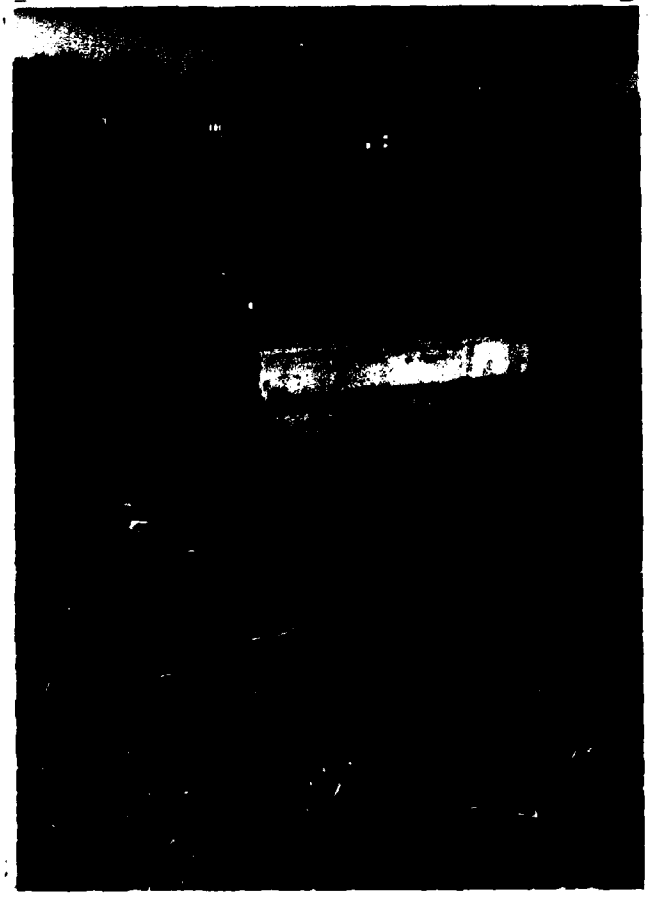


Photo 6 Principal spillway riser and sluice gate stand of pool drain.

Photo 7 Impact basin of principal spillway and toe drain outlets on wing walls.

Photo 8 Spillway outlet channel.

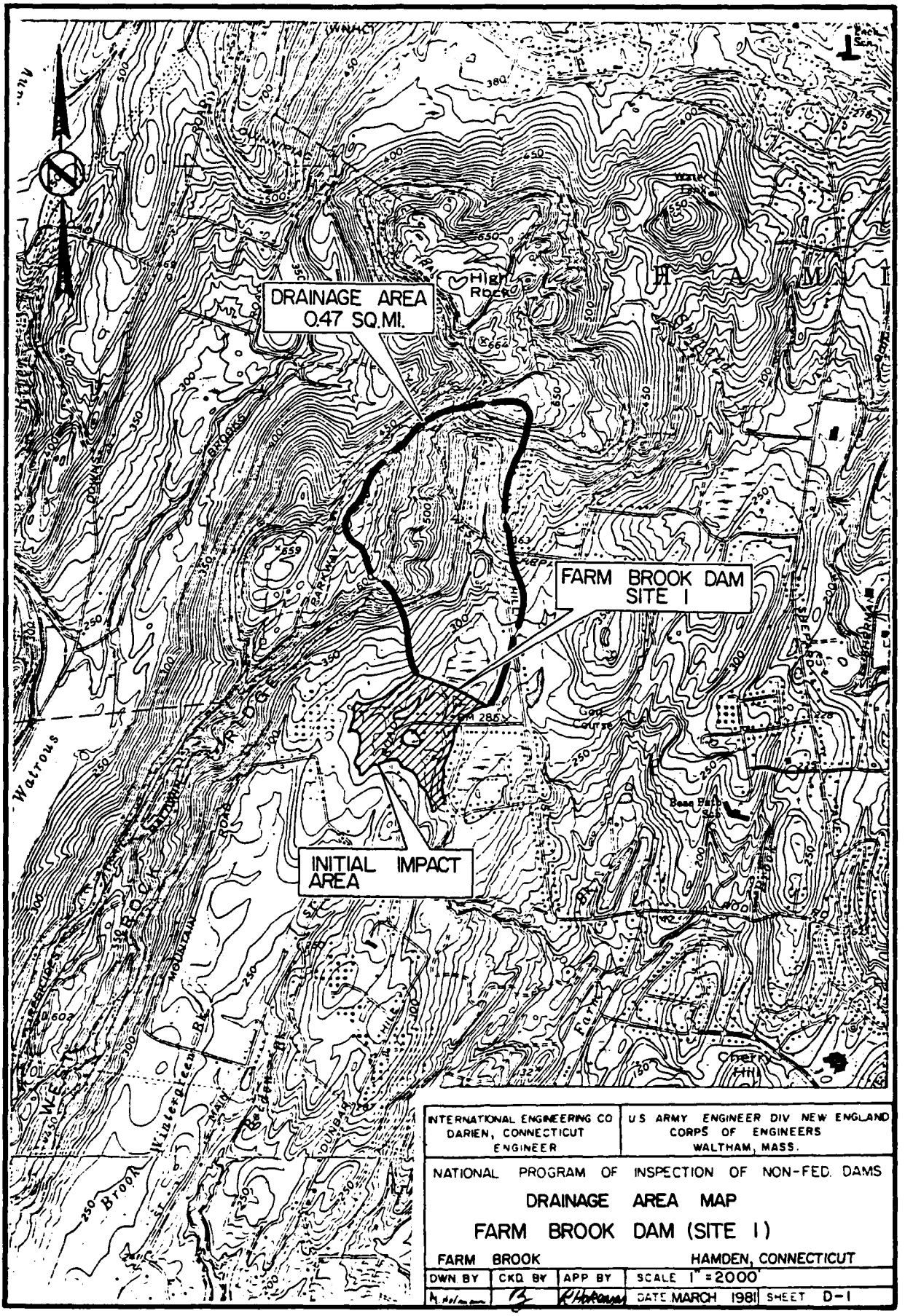
Photo 9 Crest and downstream area of emergency spillway.

Photo 10 Downstream channel beyond dam.

Photo 11. Air photo of embankment No. 2, diversion and drainage ditches, principal spillway, and principal spillway discharge channel.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



INTERNATIONAL ENGINEERING CO DARIEN, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP

FARM BROOK DAM (SITE 1)

FARM BROOK HAMDEN, CONNECTICUT

DWN BY	CKD BY	APP BY	SCALE 1" = 2000'
[illegible]	B	[illegible]	DATE MARCH 1981 SHEET D-1

HYDROLOGIC / HYDRAULIC INSPECTION

FARM BROOK PROJECT SITE 1, HAMDEN, CT

I. PERFORMANCE AT TEST FLOOD CONDITIONS

1. PROBABLE MAXIMUM FLOOD

   a. WATERSHED CLASSIFIED AS "ROLLING"

   b. WATERSHED AREA = 0.47 sq. mi.*

   c. EXTRAPOLATING FROM NED-ACE GUIDE CURVES

      PMF = 2575 cfs / sq. mi.

   d. THEREFORE PEAK INFLOW:

      PMF = 2575 x 0.47 = 1210 cfs

      1/2 PMF = 605 cfs

2. SURCHARGE AT PEAK INFLOWS (PMF AND 1/2 PMF)

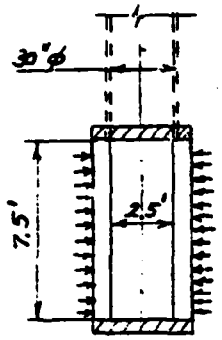
   a. OUTFLOW RATING CURVE

      i. SPILLWAYS

         FARM BROOK DAM HAS TWO SPILLWAYS. THE PRINCIPAL SPILLWAY, IN EMBANKMENT NO. 2, IS A CONCRETE

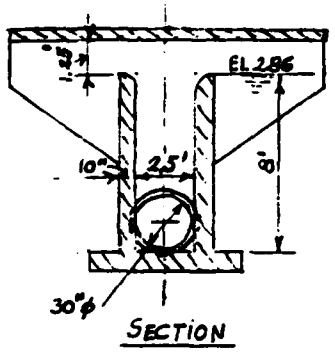
* NOTE: DRAINAGE AREA FROM "FARM BROOK WATERSHED PROJECT", 1972 AND IECO MEASUREMENTS ON U.S.G.S. MOUNT CARMEL, CT QUADRANGLE MAP.

2.a - Cont'd, SURCHARGE



PLAN

RECTANGULAR VERTICAL SHAFT SPILLWAY WITH STRAIGHT SHARP CRESTED WEIRS ON BOTH SIDES. EACH WEIR IS 7.5-FT- LONG AND ITS CREST ELEVATION IS 286 (SEE SKETCHES TO LEFT). THERE IS A 30 IN. DIAMETER, 80-ft-LONG, R.C. CONDUIT FROM THE SPILLWAY SHAFT.



SECTION

THE HEIGHT BETWEEN THE TOP OF THE DAM AND THE SPILLWAY CREST IS 5 FT. THE SPILLWAY SHAFT IS SPANNED BY A CONCRETE SLAB WHICH IS 1.25 FT ABOVE THE SPILLWAY CREST.

THE EMERGENCY SPILLWAY, WHICH IS BETWEEN EMBANKMENTS No.1 AND No.2, IS A SOD LINED CHANNEL EXCAVATED IN A KNOLL. IT IS 35-FT- WIDE WITH A BOTTOM EL. 288.2 (2.2 FT. ABOVE THE PRINCIPAL SPILLWAY CREST) AND SLOPES OF 3H TO 1V (S=3)

ASSUMING K=0.61* AND MAX. TAILWATER EL. 279.9*, FOR PRINCIPAL SPILLWAY, AND C=2.7, FOR EMERGENCY SPILLWAY, AND USING THE CREST ELEVATION OF THE PRINCIPAL SPILLWAY AS DATUM (EL. 286.0) - THEIR DISCHARGE IS APPROXIMATED BY (SEE SKETCH, P. D-4)

(*FROM "FARM BROOK WATERSHED PROJECT, 1972")

2a. Cont'd, SURCHARGE.

(1) PRINCIPAL SPILLWAY:

$$(Q_s)_1 = Ka\sqrt{2g(H+6.1)} = .61 \times 4.91 \times 8.02 (H+6.1)^{1/2} = 24 (H+6.1)^{1/2}$$

(2) EMERGENCY SPILLWAY:

EQUIVALENT LENGTH OF EACH SLOPING PORTION IS

$$L_s \approx 2/5\, S\, H = 2/5 \times 3 \times (H-2.2) = 1.2 (H-2.2), \quad (H \le 5, \ge 2.2)$$

$$\therefore (Q_s)_2^s = C L_s (H-2.2)^{3/2} = 2.7 \times 1.2 \times (H-2.2)^{5/2} = 3.2 (H-2.2)^{5/2}$$

SPILLWAY BOTTOM:

$$(Q_s)_2^b = C L_b (H-2.2)^{3/2} = 2.7 \times 35 \times (H-2.2)^{3/2} = 95 (H-2.2)^{3/2}$$

THEREFORE, TOTAL DISCHARGE OF EMERGENCY SPILLWAY:

$$(Q_s)_2 = 2(Q_s)_2^s + (Q_s)_2^b = \underline{6.4 (H-2.2)^{5/2} + 95 (H-2.2)^{3/2}}, \quad (2.2 \le H \le 5)$$

THE COMBINED DISCHARGE OF THE SPILLWAYS CAN BE APPROXIMATED (TO THE TOP OF THE DAM) BY:

$$Q_s' \approx \underline{24(H+6.1)^{1/2} + 95(H-2.2)^{3/2} + 6.4(H-2.2)^{5/2}}$$

WHERE H IS THE DEPTH OF WATER ABOVE THE ESTABLISHED DATUM (EL. 286.0)

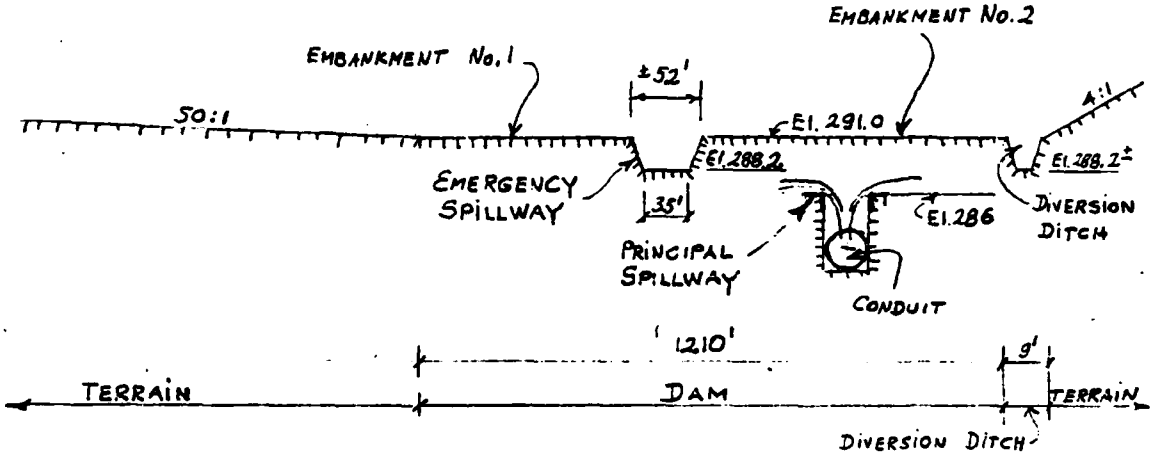
ii. EXTENTION OF THE RATING CURVE FOR SURCHARGE OVERTOPPING THE DAM AND/OR ADJACENT TERRAIN

THE FARM BROOK DAM CONSISTS OF TWO EARTHFILL EMBANKMENTS WITH A TOP ELEVATION 291.0 AND TOTAL LENGTH OF 1210 FT.

THERE IS A DIVERSION DITCH AT THE RIGHT ABUTMENT OF EMBANKMENT No. 2

Cont'd 2a, SURCHARGE

WITH BOTTOM El. (±) 288.2 AND SLOPES OF (±) 1H TO 1V. THE TERRAIN ADJACENT TO THE ABUTMENT HAS SLOPE OF APPROXIMATELY 4:1. THE TERRAIN ADJACENT TO THE LEFT ABUTMENT OF THE DAM HAS A SLOPE OF ABOUT (±) 50:1 (SEE SKETCH BELOW).



THE DIVERSION DITCH SLOPES ARE UPWARD IN THE DOWNSTREAM DIRECTION AT A GRADE OF 0.5%. IT IS APPROXIMATELY 1200-FT-LONG AND DIVERTS SURFACE WATER FROM THE SURROUNDING TERRAIN TO THE RESERVOIR BEHIND THE DAM. THE MINIMUM ELEVATION OF THE TOP OF THE LEFT BANK OF THE DITCH IS 291.3 FROM TH SCS DESIGN DRAWINGS. THEREFORE, THE DITCH WILL NOT FUNCTION AS AN EMERGENCY SPILLWAY.

ASSUMING C=2.7 FOR THE OVERFLOW AT ALL OVERTOPPING POINTS ON THE DAM AND ON THE EQUIVALENT LENGTH FOR THE SLOPPING TERRAIN, THE OVERFLOW CAN BE APPROXIMATED BY THE FOLLOWING EQUATIONS:

INTERNATIONAL ENGINEERING COMPANY, INC.

Project NDIP | Contract No. 2616-08 | Sheet D-5
Feature FARM BROOK DAM, HAMDEN, CT | Designed MP | File No.
Item | Checked EHR | Date 12/12/80 | Date 1/15/81

Cont'd, 2a, SURCHARGE

(1) SLOPING TERRAIN TO THE RIGHT OF DIVERSION DITCH:

$$L_{RS} = \tfrac{3}{5} \times 4 \times (H-5); \quad \therefore \quad Q'_{RS} = 2.7 \times 1.6 \times (H-5)^{5/2} \simeq 4.3\,(H-5)^{5/2}$$

(2) TOP OF DAM AT El. 291.0:

$$Q'_E = 2.7 \times 1167 \times (H-5)^{3/2} \simeq 3150\,(H-5)^{3/2}$$

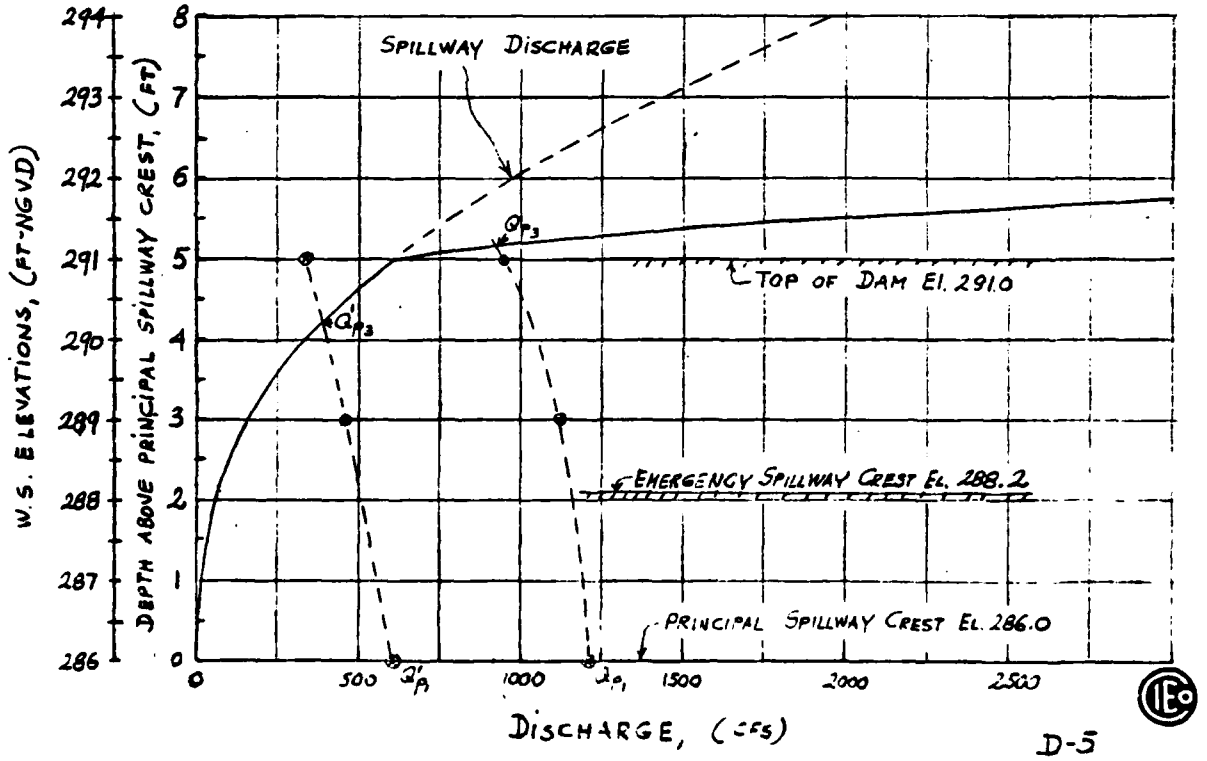
(3) SLOPING TERRAIN TO THE LEFT OF DAM:

$$L_{LS} = \tfrac{2}{5} \times 50 \times (H-5); \quad \therefore \quad Q'_{LS} = 2.7 \times 20 \times (H-5)^{5/2} = 54\,(H-5)^{5/2}$$

THEREFORE, THE TOTAL OUTFLOW RATING CURVE IS APPROXIMATED BY:

$$Q_T = 24(H+6.1)^{1/2} + 95\,(H-2.2)^{3/2} + 64(H-2.2)^{5/2} + 3150\,(H-5)^{3/2} + 58.3\,(H-5)^{5/2}.$$

THE RESULTING OUTFLOW RATING CURVE IS AS FOLLOWS:



Cont'd, 2. SURCHARGE AT PEAK INFLOWS

b. SURCHARGE HEIGHT TO PASS PEAK INFLOWS (Q_{p_1} AND Q'_{p_1}):

i. @ Q_{p_1} = PMF ≅ 1210 CFS $H_1 \cong 5.3$ FT

ii. @ Q'_{p_1} = 1/2 PMF = 605 CFS $H'_1 \cong 4.95$ FT

c. EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOWS:

i. AVERAGE POND AREA WITHIN EXPECTED SURCHARGE:

(1) POND AREA AT RECREATION POOL (El. 286.0)*: $A_{286} = 18.4$ AC

(2) AREA AT TOP OF DAM (El. 291.0)*: $A_{291} \cong 25.4$ AC

(3) AREA AT CONTOUR El. 300*: $A_{300} \cong 29$ AC

∴ AREA AT EL. 291 (MAX EXPECTED SURCHAGE): $A_{291} = 25.1$ AC

* AREAS FROM "FARM BROOK WATERSHED PROJECT", DATED 1972 (SEE STAGE-STORAGE CURVES ON P. D-7) AND USGS MOUNT CARMEL, CT QUADRANGLE MAP.

ii. ASSUME NORMAL POOL AT El 286.0

iii. WATERSHED AREA: D.A. = 0.47 sq. mi. (SEE p. D-1)

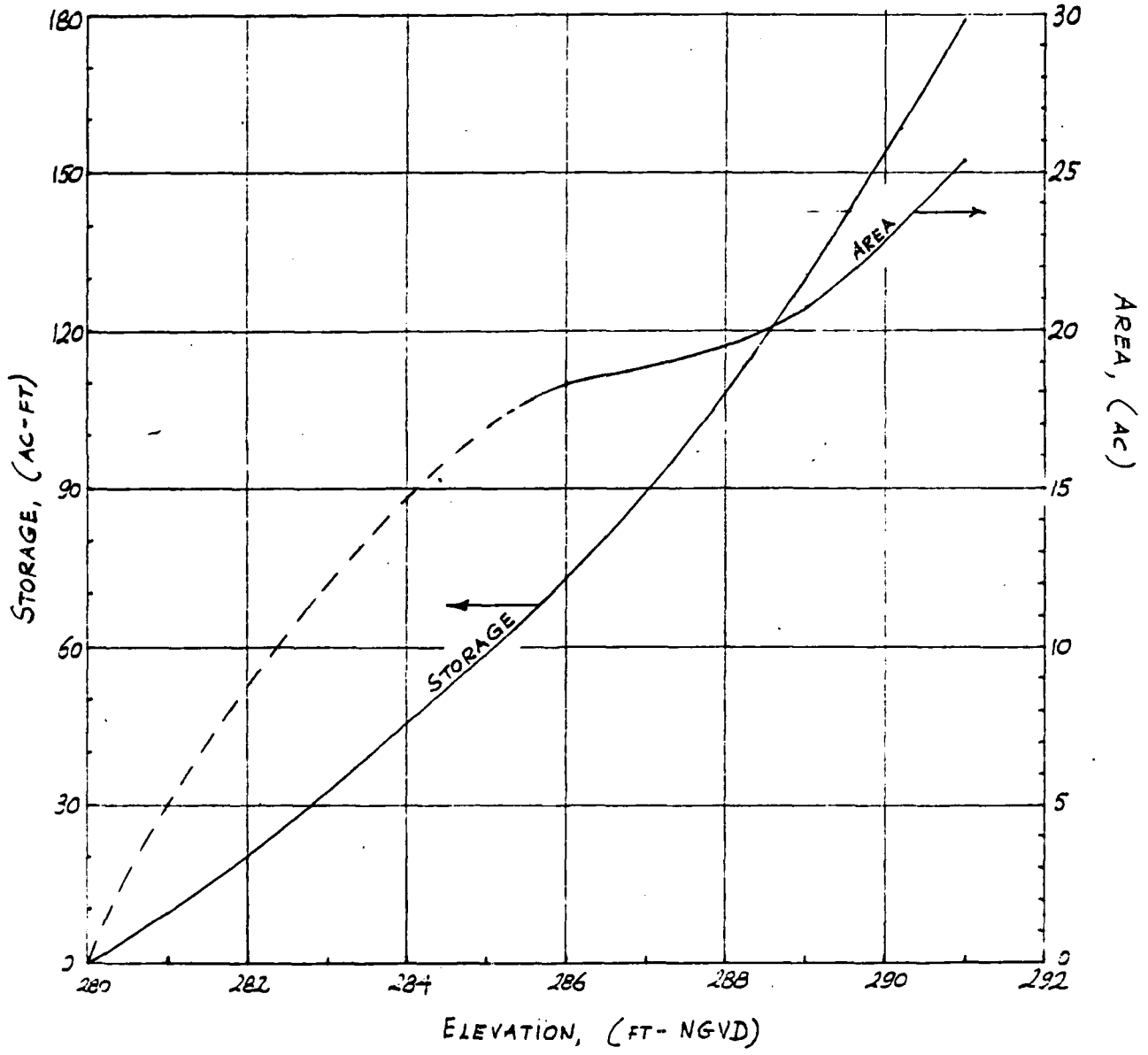
iv. DISCHARGE (Q_{p_2}) AT VARIOUS HYPOTHETICAL SURCHARGE ELEVATIONS:

H = 5 FT; V = 106 AC-FT ∴ $S = \frac{106}{0.47 \times 53.3} = 4.23$ IN

H = 3 FT, V = 58 AC-FT ∴ S = 2.32 IN.

FARM BROOK DAM RESERVOIR

STAGE-STORAGE CURVES *



* FROM "FARM BROOK WATERSHED PROJECT", 1972, USDA-SCS

CONT'd, 2c. EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOWS:

FROM APPROXIMATE ROUTING NED-ACE GUIDELINES AND 19in. MAX. PROBABLE RUNOFF IN NEW ENGLAND

$Q_{P_2} = Q_{P_1}(1 - \frac{S}{19})$ AND FOR 1/2 PMF: $Q'_{P_2} = Q'_{P_1}(1 - \frac{S}{9.5})$

∴ FOR THE PREVIOUS HYPOTHETICAL SURCHARGES:

$H = 5$ FT; $Q_{P_2} = 941$ CFS; $Q'_{P_2} = 336$ CFS

$H = 3$ FT; $Q_{P_2} = 1062$ CFS; $Q'_{P_2} = 457$ CFS

AND FOR $H = 0$; $Q_{P_2} = 1210$ CFS; $Q'_{P_2} = 605$ CFS

d. PEAK OUTFLOWS (Q_{P_3} AND Q'_{P_3})

USING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING" ALTERNATE METHOD (SEE RATING CURVE, p. D-5):

$Q_{P_3} \cong 920$ CFS; $H_3 \cong 5.2$ FT FOR Q_{P_1} = PMF

$Q'_{P_3} = 390$ CFS; $H'_3 \cong 4.2$ FT FOR $Q_{P_1} = 1/2$ PMF

3. SPILLWAY CAPACITY RATIO TO PEAK INFLOWS AND OUTFLOWS

a. SPILLWAY CAPACITY TO ELEVATION OF EMERGENCY SPILLWAY CREST:

El. 288.2; $H = 2.2$ FT $Q_{S_1} = 69$ CFS

∴ THE TOTAL SPILLWAY CAPACITY TO EMERGENCY SPILLWAY CREST IS (±)6 % OF THE INFLOW (Q_{P_1}) AND (±)8 % OF THE OUTFLOW (Q_{P_3}) AT PEAK FLOOD = PMF.

Cont'd, 3a - SPILLWAY CAPACITY RATIO TO PEAK INFLOWS AND OUTFLOWS

LIKEWISE, THE TOTAL SPILLWAY CAPACITY TO THE EMERGENCY SPILLWAY CREST IS (2) 11 % OF THE INFLOW (Q'_{P_1}) AND (4) 18 % OF THE OUTFLOW (Q'_{P_3}) AT PEAK FLOOD = 1/2 PMF.

b. SPILLWAY CAPACITY TO TOP OF DAM (TOTAL OF BOTH SPILLWAYS):

El. 291.0; H = 5 FT $\quad Q_{S_2} = 609$ CFS

∴ THE TOTAL SPILLWAY CAPACITY TO THE TOP OF THE DAM IS 50 ± % OF THE INFLOW (Q_{P_1}) AND 66 ± % OF THE OUTFLOW (Q_{P_3}) AT PEAK FLOOD = PMF.

LIKEWISE, THE TOTAL SPILLWAY CAPACITY FOR THESE CONDITIONS (3b) IS 101 ± % OF THE INFLOW (Q'_{P_1}) AND 156 ± % OUTFLOW (Q'_{P_3}) AT PEAK FLOOD = 1/2 PMF.

NOTE: THE FARM BROOK DAM HAS A 15 IN. POOL DRAIN WITH INVERT El. 278.5. THE DRAIN IS INCORPORATED IN UPSTREAM WALL OF THE PRINCIPAL SPILLWAY RISER AND USES THE 30-IN DIAM., 80-FT-LONG SPILLWAY CONDUIT AS AN OUTLET. CONTROL PASSES FROM THE POOL DRAIN UNDER HEADS NORMALLY ENCOUNTERED IN PASSING FLOODS TO THE SPILLWAYS.

II. DOWNSTREAM FAILURE HAZARD

1. POTENTIAL IMPACT AREA

A NUMBER OF HOUSES LOCATED ALONG FARM BROOK DOWN TO THE WESTERN SUBURBS OF THE CITY OF HAMDEN AND, PARTICULARLY, THOSE LOCATED (±) 500FT TO (±) 2000FT DOWNSTREAM FROM THE DAM NEAR DUMBAR HILL AND NORMAN ROADS AND HAVING 1ST FLOOR ELEVATIONS RANGING LESS THAN 13 FEET ABOVE THE BROOK, CONSTITUTE THE POTENTIAL IMPACT AREA IN CASE OF FAILURE OF THE FARM BROOK DAM.

2. FAILURE AT FARM BROOK DAM.

1ST CASE: SURCHARGE TO TOP OF DAM (EL. 291.0)

a. BREACH WIDTH

i. HEIGHT OF DAM:

TOP OF DAM El. 291.0

DOWNSTREAM TOE OF DAM (NATURAL STREAMBED) - EL. 280.0 ±

$\therefore$ H = 11 FT

ii. MID-HEIGHT OF DAM: El. 285.5 $(291 - \frac{11}{2} = 285.5)$

iii. APPROXIMATE MID-HEIGHT LENGTH: $\ell \cong 428$ FT (SEE NOTE 1 ON p 11)

* FROM "FARM BROOK WATERSHED PROJECT", 1972

iv. BREACH WIDTH (SEE NOTE 2 ON p. 11)

$W_b = 0.25\ell = 0.25 \times 428 \cong 107$ FT

NOTE 1 (SEE P. 10):

THE EMBANKMENT No. 2 WAS SELECTED FOR THE DAM BREACH ANALYSIS SINCE IT APPEARED, FROM THE INSPECTION, THAT THIS PORTION OF THE DAM IS MORE LIKELY TO FAIL THAN EMBANKMENT No. 1. THIS WAS SUBSTANTIATED BY THE INSPECTION FINDINGS WHICH INCLUDED: A WET AREA AT THE TOE OF EMBANKMENT No. 2 AND A LARGE AMOUNT OF SEEPAGE THROUGH EMBANKMENT No. 2. IN ADDITION, EMBANKMENT No. 2 SPANS THE NATURAL PASS OF FARM BROOK.

NOTE 2 (SEE P. 10):

THE PRELIMINARY COMPUTATIONS OF THE STAGE AT THE INITIAL IMPACT AREA SHOWED THAT WITH A BREACH WIDTH $W_b = 0.4\,\ell$ THE WATER SURFACE ELEVATION IN THE IMPACT AREA AFTER THE DAM FAILURE, EXCEEDED THE ELEVATION OF THE TOP OF THE DAM. THEREFORE, THE BREACH WIDTH OF THE DAM WAS ASSUMED TO BE LESS THAN THE VALUE RECOMMENDED BY NED-ACE DOWNSTREAM FAILURE GUIDELINES, NAMELY, $W_b = 0.25\,\ell$.

CONT'd, II,2 - FAILURE AT FARM BROOK DAM.

b. PEAK FAILURE OUTFLOW (Q_{P1})

i. HEIGHT AT TIME OF FAILURE: $Y_o = 11$ FT

ii. SPILLWAYS DISCHARGE AT TIME OF FAILURE:

1) PRINCIPAL SPILLWAY: $Q_{SP} = 80$ CFS

2) EMERGENCY SPILLWAY: $Q_{SE} = 529$ CFS

3) TOTAL DISCHARGE TO FARM BROOK: $Q_o = 609$ CFS

iii. BREACH OUTFLOW (Q_b):

$$Q_b = 8/27\, W_b \sqrt{g}\, Y_o^{3/2} = 8/27 \times 107 \sqrt{32.2} \times 11^{3/2} \approx 6563 \text{ CFS}$$

iv. PEAK FAILURE OUTFLOW (Q_{P_1}) TO FARM BROOK.
(BREACH DOES NOT INCLUDE EMERGENCY SPILLWAY)

$$Q_{P_1} = Q_o + Q_b = 609 + 6563 \approx 7200 \text{ CFS}$$

c. FLOOD DEPTH IMMEDIATELY DOWNSTREAM FROM DAM:

$$Y = 0.44\, Y_o = 0.44 \times 11 \approx 5 \text{ FT}$$

d. ESTIMATE OF DOWNSTREAM FAILURE CONDITIONS AT POTENTIAL IMPACT AREA:

(SEE NED-ACE GUIDELINES FOR ESTIMATING DOWNSTREAM FAILURE HYDROGRAPHS)

i. REACH OF FARM BROOK BETWEEN THE DAM AND THE IMPACT AREA;

Cont'd, II, 2d – ESTIMATE OF D/S FAILURE CONDITIONS

THE (±) 500-FT-LONG REACH OF FARM BROOK FROM THE FARM BROOK DAM TO THE INITIAL IMPACT AREA AT DUNBAR HILL ROAD HAS 10±-FT-WIDE BOTTOM AND 1.5:1 SLOPES TO A DEPTH OF (±) 6 FT. AND (±) 20:1 SLOPES ABOVE 6 FT. THE AVERAGE SLOPE OF THE REACH IS (±) 0.5%.

ii. FARM BROOK DAM RESERVOIR STORAGE AT TIME OF FAILURE

CAPACITY OF RESERVOIR TO THE EMERGENCY SPILLWAY CREST (El. 288.2)

$S_{ES}^{*} \cong 113$ AC-FT

CAPACITY OF RESERVOIR TO THE TOP OF THE DAM (El. 291):

$S_{TD}^{*} = 179$ AC-FT

* FROM "FARM BROOK WATERSHED PROJECT", 1972 (SEE p. D-7)

NOTE: THE ACE-US INVENTORY OF DAMS, DATED JAN. 24, 1979, p. F-7-15 GIVES $S_{MAX} = 119$ AC-FT.

ASSUME STORAGE AT TIME OF FAILURE: $S_{MAX} = 179$ AC-FT

iii. PEAK INFLOW TO REACH: $Q_{P_1} = 7200$ CFS (SEE p. D-11)

iv. APPROXIMATE STAGE AT POTENTIAL IMPACT AREA AFTER FAILURE OF FARM BROOK DAM:

$Q_{P_1} = 7200$ CFS; $Y_1^{*} = 13.2$ FT; $A_1^{*} = 1350$ FT^2; $Q_0 = 609$ CFS; $Y_0^{*} = 7.6$ FT; $A_0^{*} = 210$ FT^2; $V_1 = L(A_1 - A_0) = 500(1350 - 210) = 13.1$ AC-FT $< \frac{S_{MAX}}{2}$, OK

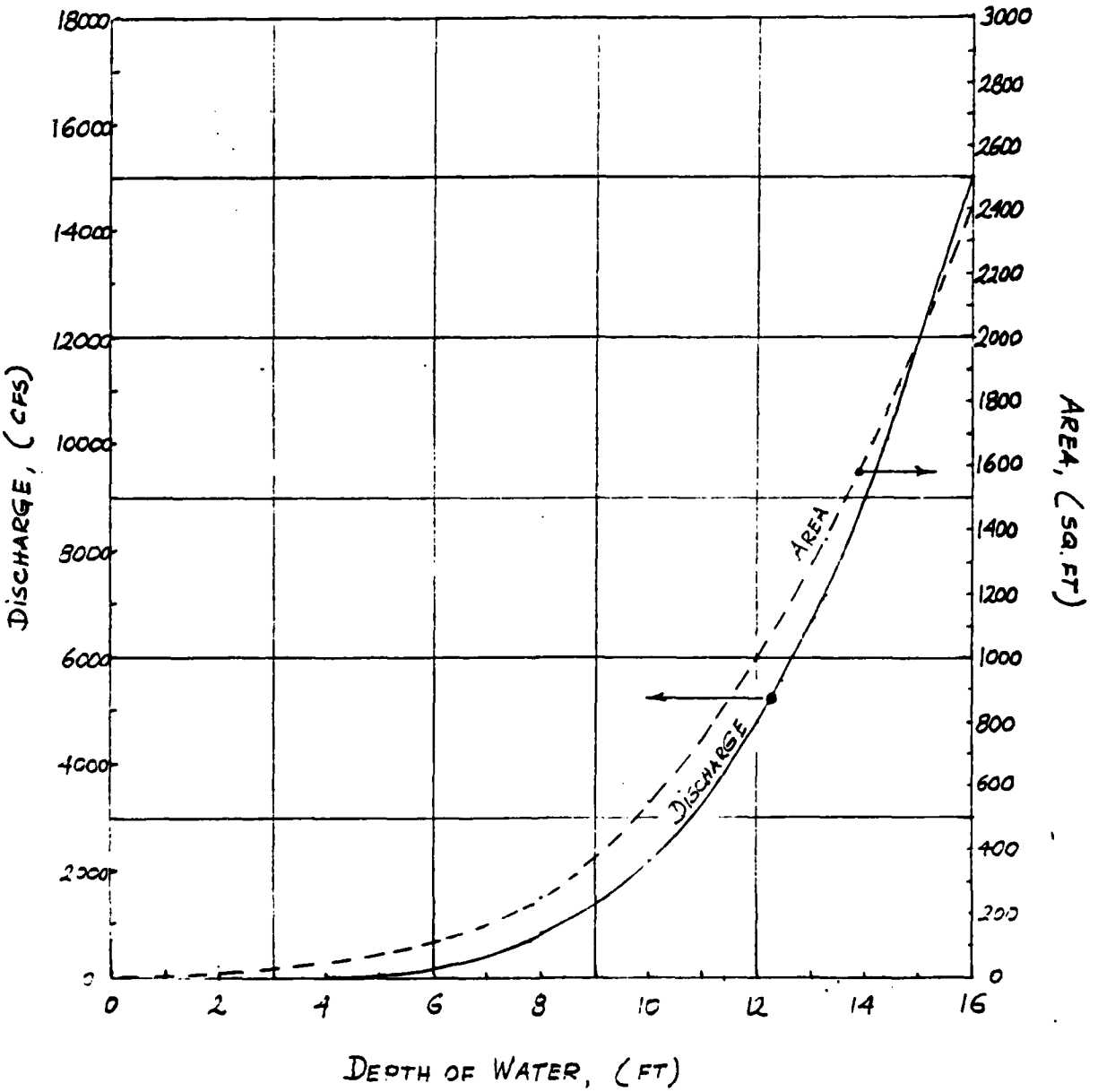
$Q_{P_2} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) \cong 6673$ CFS; $Y_2^{*} = 13.0$ FT; $A_2^{*} = 1300$ FT^2; $V_2 = 500(1300 - 210) = 12.5$ AC-FT; $\bar{V} = \frac{V_1 + V_2}{2} = 12.8$ AC-FT $\therefore Q_{P_3} = 6685$ CFS

$\therefore$ REACH OUTFLOW: $Q_{P_3} \cong 6690$ CFS; STAGE: $Y_3 \cong 13.0$ FT

* SEE STAGE-DISCHARGE CURVES FOR INITIAL IMPACT AREA ON p. D-14

INITIAL IMPACT AREA

STAGE - DISCHARGE RATING CURVES



e. APPROXIMATE STAGE BEFORE FAILURE

FARM BROOK FLOW BEFORE FAILURE: $Q_o = 609$ CFS $\therefore Y \simeq 7.6$ FT

f. RAISE IN STAGE AT IMPACT AREA: $\Delta Y = 13.0 - 7.6 = 5.4$ FT

2ND CASE: SURCHARGE TO TEST FLOOD ELEVATION 290.2

a. BREACH WIDTH

i. HEIGHT OF DAM: $H = 290.2 - 280 = 10.2$ FT

ii. MID-HEIGHT OF DAM: EL. 285.1 $(280 + 10.2/2)$

iii. APPROXIMATE MID-HEIGHT LENGTH: $\ell \simeq 406$ FT

iv. BREACH WIDTH (SEE NOTE 2 ON p. 11): $W_b = 0.25 \times 406 \simeq 102$ FT

b. PEAK FAILURE OUTFLOW (Q_{p_1}).

i. HEIGHT AT TIME OF FAILURE: $Y_o = 10.2$ FT

ii. SPILLWAY DISCHARGE AT TIME OF FAILURE

PRINCIPAL SPILLWAY: $Q_{sp} = 77$ CFS

EMERGENCY SPILLWAY: $Q_{s_E} = 313$ CFS

TOTAL DISCHARGE TO FARM BROOK: $Q_o = 390$ CFS

iii. BREACH OUTFLOW (Q_b):

$$Q_b = 8/27 \times 102 \times \sqrt{32.2} \times 10.2^{3/2} = 5587 \text{ CFS}$$

iv. PEAK FAILURE OUTFLOW (Q_{p_1}) TO FARM BROOK

$$Q_{p_1} = Q_o + Q_b = 390 + 5587 \simeq 5980 \text{ CFS}$$

c. FLOOD DEPTH IMMEDIATELY DOWNSTREAM FROM DAM: $Y = 0.44 Y_o = 1.44 + 10.2 \cong 1.5$ FT

d. ESTIMATE OF DOWNSTREAM FAILURE CONDITIONS AT POTENTIAL IMPACT AREA

i. REACH OF FARM BROOK BETWEEN THE DAM AND THE IMPACT AREA (SEE P. D-13)

$L = 500$ FT; $n = 0.05$; $S = 0.005$;

STAGE-DISCHARGE RATING CURVES ON P. D-14.

ii. DAM RESERVOIR STORAGE AT TIME OF FAILURE

CAPACITY OF RESERVOIR TO TEST FLOOD EL. 290.2:

$S = 158$ AC-FT (SEE P. D-7)

ASSUME STORAGE AT TIME OF FAILURE: $S_{MAX} = 158$ AC-FT

iii. PEAK INFLOW TO REACH: $Q_{P_1} = 5970$ CFS

iv. APPROXIMATE STAGE AT IMPACT AREA AFTER DAM FAILURE:

$Q_{P_1} = 5980$ CFS; $Y_1^* = 12.6$ FT; $A_1^* = 1180$ FT^2

$Q_o = 390$ CFS; $Y_o^* = 7.0$ FT; $A_o^* = 160$ FT^2; $V_1 = L(A_1 - A_o) = 500(1180 - 160) = 11.7$ AC-FT $< \frac{S_{MAX}}{2}$, OK

$Q_{P_2} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 5528$ CFS; $Y_2^* = 12.4$ FT; $A_2^* = 1110$ FT^2

$V_2 = 500(1110 - 160) = 10.9$ AC-FT; $\overline{V} = \frac{1}{2}(V_1 + V_2) = 11.3$ AC-FT

$\therefore Q_{P_3} \cong 5540$ CFS

$\therefore$ REACH OUTFLOW: $Q_{P_3} \cong 5540$ CFS

STAGE: $Y_3 \cong 12.4$ FT

* SEE STAGE-DISCHARGE CURVES ON P D-14

Cont'd, II,2 - FAILURE OF FARM BROOK DAM.

e. APPROXIMATE STAGE BEFORE FAILURE:

FARM BROOK FLOW BEFORE FAILURE: $Q_o = 382$ CFS $\therefore Y \cong 7.0$ FT

f. RAISE IN STAGE AT IMPACT AREA: $\Delta Y = 12.4 - 7.0 = 5.4$ FT

III. SELECTION OF TEST FLOOD

1. CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES:

a. SIZE: STORAGE* (MAX) = 179 AC-FT ($50 < S < 1000$ AC-FT)

HEIGHT* $\cong$ 11 FT ($H < 25$ FT)

*NOTE: STORAGE (SEE P. D-13); HEIGHT (SEE P. D-10)

$\therefore$ SIZE CLASSIFICATION: SMALL

b. HAZARD POTENTIAL: AS A RESULT OF THE DOWNSTREAM FAILURE ANALYSIS AND THE IMPACT THAT THE FAILURE OF FARM BROOK DAM MAY HAVE ON THE POTENTIAL IMPACT AREA DESCRIBED ON P. D-10, THIS DAM IS CLASSIFIED AS HAVING:

HAZARD CLASSIFICATION: HIGH

2. TEST FLOOD: ½ PMF = 605 CFS

THIS SELECTION IS MADE BASED ON THE RESULTS OF THE PREVIOUS ANALYSIS AND CLASSIFICATION.

CONT'd - FARM BROOK DAM

IV. SUMMARY

1. TEST FLOOD = 1/2 PMF = 605 CFS

(PARALLEL COMPUTATIONS HAVE BEEN MADE FOR PMF = 1210 CFS).

2. PERFORMANCE AT PEAK FLOOD CONDITIONS:

a. PEAK INFLOW. : $Q_{p_1}' = 605$ CFS

b. PEAK OUTFLOW : $Q_{p_3}' = 390$ CFS

C. SPILLWAY CAPACITY:

i. SPILLWAY CAPACITY TO ELEVATION OF EMERGENCY SPILLWAY CREST:

$H = 2.2$ FT; $(Q_s)_1 = 69$ CFS OR $18^{\pm}$% OF Q_{p_3}'

ii. SPILLWAY CAPACITY TO TOP OF DAM (TOTAL OF BOTH SPILLWAYS):

$H = 5$ FT; $(Q_s)_2 \cong 609$ CFS OR (*) 156% OF Q_{p_3}'

THEREFORE, AT TEST FLOOD Q_{p_1} = 1/2 PMF THE DAM IS NOT OVERTOPPED.

3. DOWNSTREAM FAILURE CONDITIONS:

(1) SURCHARGE TO TOP OF DAM (EL. 291.0)

a. PEAK FAILURE OUTFLOW: $Q_{p_1} \cong 7200$ CFS

b. FLOOD DEPTH IMMEDIATELY DOWNSTREAM FROM DAM: $Y_o \cong 5$ FT.

C. CONDITIONS AT THE INITIAL IMPACT AREA D/S FROM DAM (FARM BROOK)

i. APPROXIMATE STAGE BEFORE FAILURE: $Y \cong 7.6$ FT

ii. APPROXIMATE STAGE AFTER FAILURE: $Y_3 \cong 13.0$ FT

iii. APPROXIMATE RAISE IN STAGE AFTER FAILURE: $\Delta Y = 5 \pm$ FT

(2) SURCHARGE TO TEST FLOOD EL. 290.2

a. PEAK FAILURE OUTFLOW : $Q_{p_1} \cong 5970$ CFS

b. FLOOD DEPTH IMMEDIATELY DOWNSTREAM FROM DAM: $Y_o = 4.5$ FT

c. CONDITIONS AT THE IMPACT AREA DOWNSTREAM FROM THE DAM:

i. APPROXIMATE STAGE BEFORE FAILURE: $Y = 7.0$ FT

ii. APPROXIMATE STAGE AFTER FAILURE: $Y_3 = 12.4$ FT

iii. APPROXIMATE RAISE IN STAGE AFTER FAILURE: $\Delta Y = 5.4$ FT

APPENDIX E

INFORMATION AS CONTAINED IN THE

NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
CT	A57	NED	CT	009	03				FARM BROOK DAM SITE 1	4124.8	7256.6	16JAN81

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	CP	FARM BROOK	HAMDEN	1	51000

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VEH/DATE
RFPD	1974	C	12	11	166	60	NED	N	N	N	T	

(28) REMARKS

(29) O/S HAS	(30) SPILLWAY CREST LENGTH	(31) TYPE	(32) WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	1217	U	55	609	13500											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
STATE OF CT DEP	USDA SCS	NUTMEG CONSTRUCTION CO

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
INTERNATIONAL ENGINEERING CO INC	05DEC80	PL 92-367

(53) REMARKS

AT PEAK FLOOD = PMF.

END

FILMED

10-84

DTIC